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Official Notices.

ANNUAL GENERAL MEETING, 1915.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held at the Municipal School of Technology, Manchester, at 10.30 a.m. on Wednesday, July 14th, 1915.

Provisional Arrangements.

Wednesday, July 14th, 1915.

Morning: Annual General Meeting and Address from the President, Prof. G. G. Henderson, D.Sc.

Afternoon: "Research and Chemical Industry." Dr. M. O. Forster, F.R.S., and Dr. Chas. C. Carpenter.

Evening: Annual Dinner.

Thursday, July 15, 1915.

Morning: "Legislation and its Effect upon Chemical Industry." Mr. I. Levinstein, M.Sc.Tech.

Afternoon: "Chemical Engineering." Dr. G. T. Beilby, F.R.S.

Evening: Visit to the University Laboratories. Demonstrations by Sir Ernest Rutherford, F.R.S., Prof. W. J. Pope, F.R.S., and Prof. Harold Dixon, F.R.S.

Friday, July 16th, 1915.

Morning: "Economic Utilisation of Coal and the Production of Cheap Power." Mr. Walter F. Reid.

Afternoon: Visit to Works.

Evening: Social Meeting.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. C. C. Carpenter has been nominated to the office of President under By-law 20; Prof. G. G. Henderson has been nominated a Vice-President under By-law 20; Prof. E. C. C. Baly, F.R.S., Mr. R. H. Clayton, and Mr. Julius Hübner have been nominated Vice-Presidents under By-law 21, and Mr. Thos. Tyrer and Dr. R. Messel, F.R.S., have been reappointed Hon. Treasurer and Hon. Foreign Secretary respectively.

Members are requested to nominate, on or before May 22nd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the Secretary of the Society.

By-law 23:—An Ordinary Member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid, shall receive notice thereof from the Secretary, and shall not be submitted for election.

Charles G. Cresswell,
Secretary.

GOVERNMENT ASSISTANCE FOR INDUSTRIAL RESEARCH.

Board of Trade Announcement.

May 7th, 1915.

A joint Deputation from the Royal Society and the Chemical Society was received by the President of the Board of Trade and the President of the Board of Education at the Board of Trade Offices, 7, Whitehall Gardens, S.W., on Thursday, the 6th May. With Mr. Runciman and Mr. Pease were Dr. Addison, M.P., Sir H. Llewellyn Smith, Sir L. A. Selby-Bigge, Mr. Ogilvie, Dr. Heath, and Mr. Percy Ashley.

The Deputation, which was introduced by Sir William Crookes, consisted of: Professor A. W. Crossley, Dr. H. J. H. Fenton, Dr. M. O. Forster, Professor W. H. Perkin, Professor W. J. Pope, Professor Arthur Schuster, Professor A. Smithells, Professor J. F. Thorpe, and Mr. R. W. F. Harrison, representing the Royal Society; Dr. Alexander Scott, Professor F. G. Donnan, Professor Percy F. Frankland, Professor J. C. Philip, Sir William A. Tilden, and Dr. Samuel Smiles, representing the Chemical Society; Mr. A. Chaston Chapman (President of the Society of Public Analysts), Professor G. G. Henderson (President of the Society of Chemical Industry), Professor Jackson, and Mr. Edward W. Voelcker, representing the Institute of Chemistry.

Professor Perkin, Sir William Tilden, Professor Frankland, Professor Pope, and Dr. Forster spoke in support of Memorials from the Royal Society and the Chemical Society which had been submitted to H.M. Government on the position of the chemical industries, and the steps which might be taken to improve their status and efficiency in the United Kingdom. The speakers drew attention to the fact that the comparatively backward state of certain industries in this country is due to a failure to realise that modern industry to be successful must be based on scientific research, and to the lack of association between manufacturers and science combined with a want of scientific knowledge and appreciation of the importance of scientific work amongst the public generally, and the lack of organisation among the various chemical and allied industries.

The Deputation advocated Government assistance for scientific research for industrial purposes, the establishment of closer relations between the manufacturers and scientific workers and teachers, and the establishment of a National Chemical Advisory Committee for these purposes.

Mr. Runciman, in reply to the Deputation, pointed out that the Board of Trade fully appreciated the extent to which national industrial progress is dependent upon the utilisation of the services of men of science, and the importance of provision for the thorough training of a very much larger number of industrial chemists than are at present available. He agreed with the views expressed as to the need of closer co-operation between manufacturers and scientific workers and

teachers. The War had shown the weakness of our position in certain important respects, and he was in full sympathy with the general views expressed by the Deputation. The actual proposals would receive careful and sympathetic consideration.

Mr. Pease informed the Deputation that the particular problems to which they had drawn attention had been present to the Board of Education for some time past, and that a scheme had been approved in principle by which substantial additional assistance would be given by the Government to scientific education and to industrial research. He hoped that though the funds immediately available might not be large, they would be sufficient to enable an organisation to be brought into being at an early date, which would be capable of expansion subsequently. Mr. Pease further expressed his appreciation of the offer of assistance and advice by members of the Societies represented at the Deputation.

The text of the Memorial presented by the Royal Society was as follows :—

MEMORIAL TO THE PRIME MINISTER ON THE DEVELOPMENT OF CHEMICAL INDUSTRIES.

The President and Council of the Royal Society have recently had under consideration the state of certain chemical industries in this country as revealed by the effects of the war. These industries are of the greatest national importance; they supply materials required in many different industries, including material required for war purposes, and on them depends the welfare of immense numbers of skilled workers. We are aware that the Government at an early stage foresaw the difficulties with which the country was likely to be confronted, and an Advisory Committee, formed under the auspices of the Board of Trade, has rendered and is rendering service in the desired direction.

As representatives of Science in this country we urge that the main causes of the comparatively backward state of certain industries are: (1) Failure to realise that modern industry, to be successful, must be based on scientific research; and (2) Want of more intimate association between the manufacturers and the workers in science. The Board of Trade has already given facilities for bringing together manufacturers, merchants, and consumers, and the Treasury has recently formed a war trade department in such specialised branches of industry as we have had under consideration. It is essential for the future welfare of the country and for the permanent retention of such industries as may be established here as the result of the war, that some permanent central national organisation should be created. We venture to hope that the Government will take the necessary steps, and we submit the case for your favourable consideration now because of its urgency, and because as a body of scientific workers we know that something more is required than temporary Committees. It is generally admitted that the foreign industries which have outstripped our own, and others which increasingly threaten us, have been built up as the result of about half-a-century's recognition by our competitors of the bearing of scientific research upon manufacturers. If, as we believe, there has been neglect of this recognition here, the present crisis will no doubt lead to the development of more enlightened ideas, and we feel confident that a fresh departure in this country, under the lead of the Government, would have a most important influence upon the future of the growing industries.

It is not for us to formulate any definite scheme for giving practical effect to the representations submitted in this Memorial, but there are certain special reasons for bringing forward the matter now. One of these reasons is that the Advisory Committee which has been already appointed by the Board of Trade contains the nucleus of such a permanent organisation as in our opinion is essential for the future maintenance of our chemical industries in face of foreign competition. This Committee, which now comprises experts in several branches of chemistry bearing upon industry, might furnish material for the establishment of a larger standing committee, of the nature of an Intelligence Department, serving the chemical industries in the same way that the Commercial Intelligence Department serves merchants and traders. A further reason for our urging the matter at the present time is that in view of the existing state of some of our industries, the chemists of this country generally consider that it is imperative on national grounds that all proposed new developments should be pushed forward with as little delay as possible. Should such an organisation as we suggest be called into existence, we have reason to believe that the services and laboratories of the Chemical Fellows of the Society will be, so far as possible, at the disposal of the Government for the purpose of advising and, if necessary, of carrying out investigations which may be required by manufacturers for the solution of special problems.

We venture to hope that this memorial may receive your favourable consideration for the reasons summarised below: -

(1) Many branches of industry dependent upon foreign chemical manufacture have been seriously affected by the war. The development of these industries in this country requires a very large amount of expert co-operation, and in view of the leeway which has to be made up a considerable increase in the number of research workers is necessary in order to hasten progress and to insure the permanent retention of the new manufactures after the war.

(2) A Standing Advisory Committee comprising some of the foremost chemists in the country is already available as an organisation for the service of the nation in the present emergency. We suggest that this Committee, if suitably strengthened, might form the nucleus of an organisation such as we have in view.

(3) It is believed that if the Government would give official support to the formation of such a Chemical Committee under the auspices, say, of the Board of Trade, the confidence of manufacturers would be secured to an extent that has hitherto been unrealisable. With increased facilities of communication between manufacturers and expert advisers, it may confidently be anticipated that such advice would be more and more sought by those concerned, and our chemical industries benefited to a corresponding extent.

The President and Council of the Royal Society beg leave to assure you that the services of the Fellows are, as they always have been, at the disposal of the Government. In presenting this Memorial they are actuated solely by the desire to promote the interests of a group of large and important industries which have been particularly affected by the war. It is outside the province and beyond the resources of the Society as a purely scientific organisation to undertake administrative control of any scheme which may be formulated with the immediate object of developing trade and manufacture, but realising the vital importance of, and necessity for, a more intimate association between scientific experts and the leaders of industry, they urge most earnestly upon your Government to take the subject of this Memorial into serious consideration.

London Section.

Meeting held at Burlington House on Monday, April 5th, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE DETECTION OF SMALL QUANTITIES OF PARAFFIN WAX IN BEESWAX, AND THE DETERMINATION OF A NEW CONSTANT FOR EAST INDIAN AND EUROPEAN BEESWAXES.

BY M. S. SALAMON, B.SC., AND W. M. SEABER, B.SC., F.I.C.

The detection of small quantities of paraffin wax in beeswax is by no means an easy task, and the present methods leave much to be desired.

The most satisfactory qualitative test is that devised by Weinwurm, which consists in saponifying 5 grms. of wax, evaporating off the alcohol, dissolving the residue in 20 c.c. of glycerin and adding 80 c.c. of hot water. With pure waxes an almost clear solution should be obtained, while with those containing as little as 4% of paraffin wax, the solution is no longer clear, but thick and opaque, and with 8% flakes are observed. Unfortunately this test is not reliable. Certain waxes of European type often give a cloudy solution, although quite pure; nearly all the waxes of the East Indian type also give a cloudy solution. Insect waxes and carnauba wax when present in the sample behave like paraffin wax. If the paraffin wax used to adulterate the beeswax has a low melting point, such as 42°—45° C., even 8% can be present without affecting the Weinwurm test.

The determination of hydrocarbons affords a fairly satisfactory means for the detection and estimation of large quantities of paraffin wax, but it is a long and somewhat tedious process, and on account of the rather wide limits for the natural hydrocarbons, it is not of much use for small quantities.

Then, again, a consideration of the acid and ester values is capable of giving an approximate estimate of paraffin that may have been added to a European type of beeswax, but in the case of East Indian beeswax the limits for those figures are too wide to admit of more than a very rough estimate. In fact, if the amount of paraffin present were small, these figures would not reveal its presence at all. By "European type" is meant a beeswax with an acid value of 17 to 20 and an ester value of 68 to 78, while the East Indian waxes have acid values of 6 to 10 and ester values of 75 to 120.

We therefore have been searching for some time for a method that shall afford an easy means of detecting small quantities of paraffin wax, particularly in waxes of the East Indian type, and have arrived at the following conclusions:—All pure beeswaxes, whether of the European or East Indian type, yield, after an hour's saponification with $N/2$ alcoholic potash (in the proportion, 10 c.c. $N/2$ alcoholic potash and 10 c.c. alcohol for every gram of wax) a perfectly clear solution. If about 15%, or more, of paraffin wax is present, insoluble oily droplets are distinctly noticeable at the bottom of the flask or floating through the hot liquid. If, however, the percentage of paraffin wax falls much below 15%, it appears to be soluble in the soaps present and cannot be detected in the course of the saponification, hence a special method is necessary for its detection.

It occurred to us that the paraffin wax would be far less soluble in the hot alcoholic solution than the hydrocarbon natural to the beeswax, and that by observing the temperature at which the hot alcoholic solution becomes turbid, some indication would be obtained as to the presence or absence of paraffin wax, and from a considerable number of observations we find this to be the case.

With pure beeswax the temperature at which a cloudiness appeared in the hot saponified alcoholic solution is practically constant, both in the case of waxes of the European type and those of the East Indian type, but owing to the difference in composition of these two types of wax, it is only to be expected that the two varieties will have different clouding points, and this we found to be the case.

Over a hundred samples, embracing nearly every commercial variety, have been examined, and the extreme limits of temperature at which a cloudiness appeared in the hot alcoholic solution were 59·5° C. to 60·5° C. for waxes of the European type, and 56° C. to 57° C. for waxes of the East Indian type.

In the presence of as little as 5% of paraffin wax, however, these points are considerably disturbed. The method of carrying out the operation is as follows:—One grm. of wax is saponified over the flame for one hour with 10 c.c. of $N/2$ alcoholic potash, and 10 c.c. of alcohol (industrial alcohol may be used for the purpose). The flask is taken off the flame and a thermometer inserted, and the liquid stirred continuously until at a certain temperature the solution becomes cloudy. The point is very sharp and constant. In the case of pure waxes, the cloudiness is followed by immediate precipitation of large flocks; with adulterated samples, however, the clouding is gradual and flocculation does not occur until a lower temperature is reached. The presence of carnauba, stearin, insect, or Japan wax, does not appear to interfere appreciably with this point, but the presence of as little as 5% of paraffin wax raises the point considerably. In the case of waxes of the East Indian type, 5% of paraffin will raise the point from 56° C., the figure for pure waxes, to 61°—62°, and 10% raises it to 69°—70° C. With waxes of the European type, the temperature of clouding rises from 60° C. for pure waxes, to 63°—64° C. for 5% paraffin, and to 71°—75° C. for 10% paraffin.

We append some figures showing the effect of the addition of 5% and 10% of paraffin wax to some of the usual varieties met with in commerce.

Waxes of the European type.

	Original pt.	5% Paraffin.	10% Paraffin.
Benguella beeswax	60°	64°	74·5°
Spanish beeswax	60°	63°	73·5°
Morocco beeswax	60°	65°	75°
East African beeswax	60°	64°	74°
English beeswax	60°	66°	75°
West African beeswax	60°	64°	75°
Abyssinian beeswax	60°	64·5°	75°

Waxes of the East Indian type.

	Original pt.	5% Paraffin.	10% Paraffin.
Chinese beeswax	56°	62°	70°
Calcutta beeswax	56°	62°	70°

The paraffin wax used varied in melting point from 50° C.—60° C.; for paraffin of very low melting point such as 42° C. the clouding point is a little lower, usually about 63° C. for 5%, but the presence of such a paraffin so affects the

melting point and the other physical characters that its presence is usually easily detected, and moreover it is very rare for a low-melting paraffin to be used as an adulterant, the adulterators usually selecting one with a melting point nearer that of beeswax itself.

The following figures on three commercial samples recently examined may be of interest.

No.	Acid value.	Ester value.	Melting pt.	Clouding pt.
1.	18·5	68	62° C.	Not clear
2.	17·9	71·7	63° C.	64° C.
3.	17·9	70	63° C.	67° C.

It will be noticed that the ester and acid values of all of them are somewhat low, and this, coupled with the clouding point, leaves little doubt that they were all adulterated with from 5—15% of paraffin.

It also may be noticed that although these samples were adulterated, yet the figures are well within the limits laid down by the new B.P.

We do not claim that the clouding point is capable of estimating accurately the percentage of paraffin wax present, but it does give a very fair approximation, and so constant is the clouding temperature of pure beeswax that any disturbance of this point should be a valuable indication of adulteration or abnormality.

Discussion.

Mr. W. F. Reid said the observation recorded by the authors was most interesting, and no doubt would prove to be of great use in testing samples; but he would like to see some evidence that the impurity was paraffin wax. When control experiments were made in the laboratory, they might be certain that the reaction was due to paraffin wax; but he had come across many samples of undoubtedly pure beeswax that contained a good deal of unsaponifiable matter. As Vice-Chairman of the British Bee Keepers' Association he had examined many hundred samples of wax. Undoubtedly bees under some conditions produced wax containing unsaponifiable matter which was not paraffin. By taking a comb of virgin wax, which was white, a wax free from propolis could be obtained; but usually in melting wax the propolis was partly absorbed by the wax, so that there was always a certain proportion present. If old, pollen-clogged combs were melted down in boiling water no wax was obtained at first; but later it was possible to get a wax quite different from that obtained from new combs, which had only been bred in for one year. Those were points that he would commend to the authors' attention on which to make experiments on wax, the origin of which was known, if possible produced by their own bees.

The wax was chiefly used for shoe-polishes; another use was for making the foundation on which the bees made their combs. Instead of leaving the bees to spend their time building combs, nowadays a bee keeper supplied them with a sheet of foundation with the impress of the cells on it. The bees drew this wax out into cells, and they did not have the trouble of secreting the wax, and consequently did not lose the time during the honey harvest which was necessary for secreting the wax. It had been said that those combs were sometimes made of ceresin or paraffin wax; but that was quite untrue in this country. He had never met with a sample of foundation made with mineral wax. If such materials were given to bees, they at once tore them down. The wax from Africa and East India was made by a different kind of bee; it generally had a lower melting point, and if it were used for a foundation for British bees, they tore it down. The odour of another species of bee was hateful to our bees, and they rejected it.

A METHOD OF ASSAYING COPPER.

BY ARTHUR FRASER.

The following modification of the well-known "iodide" method of assaying copper has been in use in the writer's laboratory for over fourteen years. As he is unaware that anyone else has tried it, and as it has proved exceedingly useful in his own work, he ventures to bring it to the notice of other assayers, especially those who have much routine work in determining copper, either in ores or other compounds.

It depends on the action of sodium fluoride on acid solutions of ferric salts, with the iron of which it forms a stable compound, Fe_2F_6, preventing any subsequent reaction between these salts and potassium iodide. So strong, indeed, is the "affinity" of fluorine for ferric iron, that if sodium fluoride be added to a solution containing ferrous and cupric salts the latter are immediately reduced to the cuprous state, or, if in acetate solution, cuprous oxide is precipitated.

The idea of employing sodium fluoride to prevent the reaction between ferric salts and potassium iodide occurred to the late Mr. R. Wightwick Roberts in 1898, and the following process was subsequently elaborated by the writer.

The following are the reagents required:—A standard solution of sodium thiosulphate, 1 c.c. = 10 mgrms. Cu; a solution of iodine in potassium iodide, 10 c.c. = 1 c.c. thiosulphate; a solution of starch (if the starch solution is made with caustic potash, as recommended in Sutton's "Volumetric Analysis" (ninth edition), it is necessary to acidify with acetic acid before using); a solution of sodium acetate, about 1 in 5, rendered just acid with acetic acid; a solution of sodium fluoride—about 45 grms. of the commercial salt are well shaken up in a litre of water, allowed to settle, and the clear solution drawn off.

The process, as carried out in the writer's laboratory, is as follows:—1 grm. of the sample—or, if very rich in copper, 0·5 grm.—is weighed into a porcelain evaporating-dish, of about 14 cm. diameter, and treated with 5 c.c. of hydrochloric acid and 15 to 20 c.c. of a mixture of nitric and sulphuric acids (12 to 1). Unless the results are wanted quickly, the samples are weighed out in the evening and left standing all night in the acids. In the morning the contents of the basins are evaporated to dryness by gentle heat. The heat is then increased till almost all the free sulphuric acid is driven off, the dish is cooled, 5—6 drops of dilute sulphuric acid (1 : 1) are added, followed by about 20 or 30 c.c. of water, a stirring-rod is put in, and the dish is warmed till all the copper sulphate is in solution and then allowed to cool.

About 10—20 c.c. of sodium acetate solution is now added, followed by from 20 to 50 c.c. of sodium fluoride solution. In practice the fluoride is poured in till the red colour of the iron acetate has disappeared, and 10 or 15 c.c. more added. Excess has no effect on the accuracy of the assay.

Potassium iodide crystals (3 to 5 grms.) are now added, and the liberated iodine is titrated in the usual way with thiosulphate and starch indicator. To avoid possible loss of iodine by volatilisation, it is well to begin running in the thiosulphate when commencing to stir gently the contents of the basin.* Iodine solution is then dropped in from

*When the ore contains lead or bismuth the starch should be added betimes, as the yellow colour due to the former, or the brownish colour due to the latter, may be erroneously attributed to free iodine. Except for this brownish colouration, in which, however, the disappearance or reappearance of the blue starch iodide is quite marked, bismuth seems to have no influence on the results.

a burette till the blue starch-iodide colour reappears, and the amount—less the 2—4 drops required to give a distinct blue tinge to the liquid—deducted from the reading of the thiosulphate burette. This is especially necessary with ores containing a dark gangue, which, on being briskly stirred, imparts a purple tinge to the mixture, and is apt to lead to a few drops excess of thiosulphate. The operator, however, soon learns to distinguish between the colour of the starch iodide in the creamy cuprous iodide, and that due to the gangue, and he seldom requires more than 2—10 drops of iodine (equal to 0·01—0·05 c.c. of thiosulphate) to come back to the neutral point.

With low grade ores of 1—2% Cu, the reaction with potassium iodide is often very slow, especially when the presence of a large quantity of iron has led to the addition of an excess of sodium acetate, and the blue starch-iodide colour keeps on returning in a disconcerting manner. Thiosulphate must be added, however, till the liquid remains permanently decolorised. When many such ores are to be tested it saves time to have a dozen burettes in use at once. The reaction may also be accelerated by using little more acetate than is sufficient to neutralise the free sulphuric acid. Care must be taken, however, to add fluoride in excess; 50 c.c. of this solution is sufficient for 0·5 grm.

With sulphide ores containing much antimony or arsenic, a slight variation in the process is necessary, as the antimonic and arsenic acids are apt to be partially reduced during drying, probably by unoxidised sulphur, and, reacting subsequently with the liberated iodine, cause an apparent shortage in the copper contents. It is well, therefore, with such ores, after drying and driving off any residual sulphur, to treat them a second time with the three acids and again dry. Then, after dissolving in water, and before adding the acetate, a solution of potassium permanganate (1 c.c. = 0·5 c.c. thiosulphate) is added drop by drop, at intervals, as the reaction is rather slow towards the end, till a last drop permanently changes the green colour of the liquid to a greyish violet. If the oxidation by the nitric acid has already been complete, one drop of permanganate is sufficient. The operator then proceeds as above, deducting, however, 0·02 c.c. (=0·02% Cu) from the reading of the thiosulphate burette. Or he may just destroy the violet, and bring back the green colour, with a very dilute solution of ferrous sulphate, and make no deduction. The writer has made many tests, adding as much as 150 mgrms. of As or Sb to half-gram portions of a matte of known copper contents, and, by means of the above precautions, has obtained no sensible difference in the percentage of copper.

When the result of a copper assay is required in a hurry the method may be shortened in the following manner:—The sample is weighed into a flask, attacked with the three acids, boiled down and dried over a naked flame, cooled, dissolved in water, and poured into a dish, using the acetate and fluoride solutions to rinse out the flask, in order to reduce the volume of the liquid. The titration then proceeds as usual. The results are accurate, and the time required 25 to 30 minutes. The whole process could be equally well performed in the flask, but the fluoride is apt to attack the glass. With rich sulphide ores and mattes, however, it is not always easy to get all the copper into solution by this quick treatment.

Though the addition of sodium acetate is convenient in giving an indication of the amount of iron present, and also in preserving the glaze of the dishes, copper may be titrated almost equally well in the presence of a little free sulphuric or hydrochloric acid.

Iron may also be estimated by a similar process, and with sufficient accuracy for all technical purposes, in chloride solutions containing free acid. The writer was pleased to find his own experience on this point fully confirmed, and, indeed, anticipated, by A. F. Joseph (this J., 1910, **29**, 187). In acetate solutions the reduction of the ferric salt is only partial. In sulphate solutions it is complete, but the reaction is so slow that the operator is left in doubt as to the exact end-point of the titration. In the presence of copper, however, the reduction of ferric sulphate by potassium iodide is both rapid and complete.

A rapid and simple process for the determination of copper and iron in the same sample or solution thus becomes available. Two equal portions, A and B, are taken; B is treated with sodium fluoride (using a drop or two of thiocyanate solution as indicator), while to A an equivalent volume of water is added; and both are then titrated with potassium iodide and thiosulphate. The amount of thiosulphate consumed by A gives the Cu+Fe, and that by B the Cu only; the difference in c.c. of thiosulphate × 0·8786 gives Fe.

In a sample containing 10·05% Fe and 0·20% Cu, the writer found 10·06% Fe and 0·19% Cu.

The presence of arsenic acid does not interfere with the technical accuracy of the test, but it causes the blue colour of the starch iodide to return slowly after the titration is finished. To ascertain the amount of this subsequent reaction in the ordinary course of work, and also to illustrate various points in the foregoing paper, tests were made with a matte containing 32·49% Cu and 38·10% Fe, to which arsenic or antimony was added. The samples were treated as above described with acids, and titrated, some with the addition of sodium fluoride and some directly. The results showed that, even in the presence of a large amount of arsenic, the error is insignificant, and the subsequent liberation of iodine, during the 30 minutes succeeding the titration, is very small (maximum 0·13 c.c. of thiosulphate). Indeed, by observing the time from the addition of iodide till the end-point of the titration, and then just destroying the returning blue at the end of a similar period, the operator can calculate back to the exact amount of thiosulphate required for the Cu+Fe.

The advantages claimed for the method are:—

(1) General applicability. It serves equally well for poor copper ores of 0·5%, and rich ores and regulus of 70%.

(2) Accuracy. Tested frequently against the electrolytic method it has proved itself fully equal, if not superior, to it, especially in the presence of other metals liable to be deposited on the cathode. The results of twelve check assays against the electrolytic method showed a maximum difference of 0·1% Cu (mean 0·052%). It gives, moreover, very concordant results, and differences of 0·1% in duplicate assays from the same packet may be confidently attributed either to insufficient preliminary treatment with acids or to spurting during evaporation. To give an idea of the concordance of results obtained in the course of everyday work by the method described above, the writer has made a list of the differences shown between all the duplicate copper assays made in his laboratory during the first six months of last year (and by different operators). Many of these assays were of loose stones brought by miners and prospectors, in which great accuracy was not required, nor were any pains taken to obtain it. The list comprises ores of all kinds and grades, as well as mattes and regulus of from 20% to 65% of copper. In a total of 663 assays in duplicate the average difference was 0·044% Cu. 453 showed differences varying between 0 and 0·05%. In only 18 cases were there differences of over 0·15% Cu, and of these last such as had been repeated proved that the discrepancies were due either to insufficient treatment with acids, or to spurting during evapo-

Simultaneously and independently, the work of Wologdine has been criticised and the subject investigated by Heyn, Bauer, and Wetzel (Mitt. K. Materialprüfungsamt. Berlin, 1914, [2], 89), and Goerens (Stahl u. Eisen, 1914, **12**, 500).

Heyn, Bauer, and Wetzel include a theoretical examination of the transmission of heat through solids and a valuable survey of the various methods of experiment which have hitherto been used. For various reasons they reject all these. In the case of the calorimetric method referred to above, they give as reasons the uncertainty of the effective area of transmission, although we believe that the difficulty is eliminated by the use of the "guard ring" principle mentioned above. They prefer a method based on measurements of the temperature gradients in a brick heated at one end in a special apparatus (see this J., 1915, 426). The deduction of the conductivity from these observations, though perhaps theoretically sound, is a process of considerable complexity, and the results obtained would suggest that it is scarcely justifiable. Thus, they find that the conductivity of a magnesia brick is less than that of common fireclay brick. The magnesia brick employed, judging from the chemical and physical data furnished, is one of a normal type which, it is a matter of common experience, conducts heat very much better than fireclay brick. The same applies to their results for a graphite brick. Contrary to our experience, they find that the conductivity of magnesia increases slightly with temperature.

Goerens, on the other hand (*loc. cit.*), retains the calorimetric method but seeks to obtain parallel heat flow through the brick by means of the "guard ring" principle. Both calorimeter and jacket are of the flow type as used by Wologdine. The temperature slope through the specimen was measured by a series of couples, while the heating was effected by an electrical hot plate. Normal bricks of commerce were tested. Goerens' results agree substantially with ours, although they appear to be generally slightly lower, and he finds with us a decrease in conductivity of magnesia with rise of temperature.

Clement and Egy (Physical Review, 1909, **28**, 71) have employed an entirely different method in some measurements on fireclay material; this was prepared in the form of a hollow cylinder, along the axis of which heat was developed electrically and hence the quantity of heat generated per unit of length could be calculated. Thermo-junctions, placed in the cylinder at different distances from the centre, enabled the temperature gradient along a radius to be arrived at and thence, by calculation, the thermal conductivity of the material. The results obtained were slightly lower than ours. The chief practical objection to the method seems to be the necessity of constructing special test-pieces for the measurement. In this and other methods there has also to be considered the probable disturbance of the flow of heat resulting from the insertion of a number of thermo-couples into the test-piece.

The apparatus employed in our experiments is shown in Fig. 1. It consisted of a gas-heated furnace built up in two sections. The lower section, AA, was a rectangular body of fireclay encased in sheet iron and stayed together with tie rods. It was heated by means of a large rectangular (15×95 mm.) Méker gas burner, B, operated by compressed air, and introduced into the base of the furnace. A round hole, O, in each end of the furnace permitted the escape of products of combustion. The top of this furnace body was closed by a thin sheet iron plate, P (⅛ in.), in the experiments at the lower temperatures. This had a double advantage, in separating the flame from the thermo-couples used in temperature measurement, and also in helping to keep uniform the temperature on the lower face of the test brick. Of course this plate did not last long on account of oxidation, and in the higher temperature experiments, when optical methods of temperature measurement could be employed, it was omitted altogether.

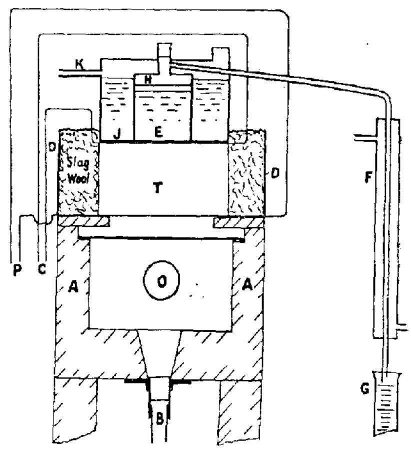

FIG. 1.

The upper section of the furnace contained the test brick, T. This was carried by pieces of firebrick ¾ in. thick, which rested on the lower section, and all chinks were sealed by means of fireclay and thin firebrick pieces. Then a sheet iron casing, D, of the same size as the lower casing, was placed in position round the brick and all the space intervening between it and the brick (3 in. to 4 in.) was filled with slag wool, or, for the high temperature experiments, kieselguhr. One advantage of this design of top section was its small heat capacity combined with high thermal resistance, which shortened materially the time necessary to get the apparatus into thermal equilibrium during an experiment.

The temperature fall across the brick was measured usually by two thermo-couples, and this required considerable care. After repeated trial a satisfactory method was found. It was necessary to isolate the lower couple, P, from any possible contact with flame gases. To this end it was enclosed in a thin-walled silica tube of small bore (1·5 mm.) which was cemented into a groove cut in the lower face of the brick. A cement of composition adjusted to the temperature attained was employed, usually a mixture of magnesia, sodium silicate, and fireclay slip. The depth of the groove was such that the couple was flush with the surface of the brick. The silica tube projected sideways on each side of the brick, and to allow for this a slot was cut in the outer iron case of the upper section. A platinum platinum-rhodium couple was used.

When the temperature of the lower face exceeded 900° C., it was taken with a Holborn-Kurlbaum optical pyrometer sighted on the middle of the lower face through one of the round flue holes of the furnace, the iron plate being discarded. Comparison of the temperatures thus determined with those deduced by means of the thermo-couple showed agreement to 10° C. over the range 900°—1400° C. The determination with the optical pyrometer was much the more convenient

method when possible, and had the advantage of really measuring surface temperatures. The inside of the furnace was doubtless for our purpose a close approximation to an optically black body. The temperature of the upper face of the brick was measured by means of a couple, C, of silver and constantan, lying in a groove cut so that the couple was flush with the surface. Good contact with the brick and care in the placing of the couple were essential. To attain this, a groove of such a size that the couple had to be lightly tapped in was cut by means of a hack saw. The groove being of the correct depth, the couple was so fixed in the proper position. This was a detail of great importance, particularly in the study of high conductivity bricks, for only by care in the determination of the temperatures, and particularly that of the upper face, could adequately concordant results be obtained. The cold junctions of the couples were maintained at constant temperature by immersion in a vessel through which cold water flowed.

Special experiments were made to confirm the reliability of this mode of measuring the temperatures of the faces. Holes were bored right through the brick parallel to, and ¼ in. from the groove carrying the thermo-couples. By means of thermo-couples passed through these holes the temperatures of the brick at the region of the holes could be measured and thence those of the surfaces deduced by extrapolation. It was found that the temperatures of the surface thus arrived at were in satisfactory agreement with those measured directly as above. The experiments were made on a certain magnesia brick, and the value for k obtained when using the temperatures of the surface measured directly was 0·0163, and 0·0164 when using those deduced by extrapolation. An exploration of the temperature distribution of the faces of the brick showed that an adequate uniformity over the centre portion was attained.

On the top of the brick was placed the calorimeter (Figs. 1 and 2). This was made of sheet copper of 20 gauge. It was 9 in. long, 4½ in. wide, and 3 in. high, the bottom being made as flat as

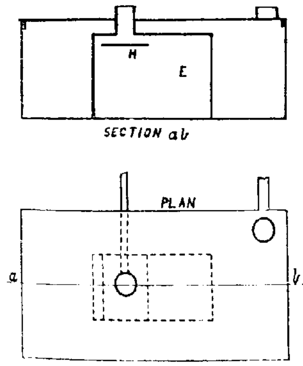

FIG. 2.

possible. In the calorimeter there was fixed an inner chamber, E, 4 in. long by 2 in. wide and 2½ in. high, which formed the calorimeter proper on which measurements were made. The volume of water distilled from this inner chamber was taken as a measure of the quantity of heat transmitted by a central portion of the brick 4 in. by 2 in. in section. The whole calorimeter was covered by a loosely fitting lid, through which projected a tube by which fresh water could be added to the inner chamber when desired. During an experiment this was closed by a rubber stopper. Steam distilling from the inner vessel passed by a sloping tube running through the outer vessel to a metal condenser, F, at the side. The condensed water was collected in a measuring cylinder, G. The bridge, H, fixed across the inner vessel near the top, was intended to prevent "priming." It was found to be quite effective unless the boiling was exceedingly violent.

The outer chamber, J, was furnished with an overflow tube, K, to maintain the level therein constant during the preliminary heating, the requisite hot water being fed in through an opening made in the lid. During the experiment proper, the feed to the outer chamber was cut off and the water therein boiled away, just like that of the inner chamber, except that it was not collected. It served to form a hot water and steam jacket to the true inner calorimeter. It proved advantageous to surround the inner chamber with a non-conducting jacket, for which purpose sheet rubber was found very satisfactory.

The joint between the calorimeter and the test brick was another detail on which not a little care had to be expended. The most satisfactory jointing was found to be a mixture of clay slip and magnesia brick dust ground to pass a 90-mesh sieve. This was mixed with water to form a thin paste, which was applied to the wetted surface of the calorimeter, and spread out into a smooth layer thicker at the middle than at the side. The calorimeter was then quickly placed in position, pressed down with a little working backwards and forwards, and a very thin joint with good contact resulted. With care any undesirable entrapping of air bubbles in the joint could be avoided.

To carry out an experiment, the apparatus was set up in accordance with the description given above. The burner was lit and the temperature of the lower face brought quickly to the required temperature and kept there for about one hour before readings were taken, during which time the apparatus gradually acquired thermal equilibrium. During this period the water in the inner chamber was not allowed to distil over. Instead, a reflux condenser was attached to the inner vessel and the steam was condensed and returned to the calorimeter. The metal condenser at the side was meanwhile plugged. The waste water from the reflux condenser was used to maintain constant level in the outer compartment of the calorimeter.

When it was desired to make measurements, the reflux condenser was removed and the opening to the inner chamber tightly closed with a rubber stopper. The steam passed over and was condensed at the side and collected in a measuring cylinder, usually for an interval of 5—10 minutes. From the volume of water collected per minute, the temperature difference, the distance across the brick, and the dimensions of the base of the inner chamber of the calorimeter, the average coefficient of conductivity was calculated for the range of temperature in question, assuming the validity of equation 1.

Thus, suppose that 22·6 c.c. of water is collected in five minutes in testing a brick 1½ in. thick when the temperatures of its lower and upper faces are 1290° and 485° C. respectively. The area of the base of the inner vessel is 8 sq. ins. or 51·6 sq. cms. We are measuring then the transmission of heat by a portion of the brick 51·6 sq. cm. in area and 3·81 cm. thick. The mean coefficient of conductivity for the temperature range is then:—

$$k=\frac{Qd}{a(\theta_2-\theta_1)t}=\frac{22\cdot6\times536\times3\cdot81}{51\cdot6\times(1290-485)\times5\times60}=0\cdot0037.$$

A number of results obtained with common refractory materials are included below. The

fireclay bricks were of an ordinary commercial brand. The "soft fired" specimens referred to were made from the same batch as the "hard fired" but had not been kilned at such a high temperature. The tests were made on bricks 1½ in. thick because the temperature range across the brick was smaller than in the case of 3 in. and 2½ in. bricks, and therefore the variation of conductivity with temperature could be more closely followed. The same applies to the experiments with the magnesia bricks, which were of a commercial brand.

The chemical and physical data in Table 1 will serve to characterise the specimens. In this table the apparent specific gravity is the ratio of the mass of the brick to the total volume, *i.e.*, including pores, and the true specific gravity is the ratio of the mass to the volume occupied by the solid matter of the brick, *i.e.*, excluding pores. The method of determination would take no account of closed pores. The corresponding porosities are also given. P_a is the ratio of the volume of the pores to the total volume of the brick, and P_b the ratio of the volume of the pores to the volume of the solid portion of the brick.

θ_1 and θ_2 a space is enclosed, the area of which is

$$\int_{\theta_1}^{\theta_2} k_\theta d\theta = \int_{\theta_1}^{\theta_2} (a + b\theta + c\theta^2) d\theta$$

$$= a(\theta_2 - \theta_1) + \frac{b}{2}(\theta_2^2 - \theta_1^2) + \frac{c}{3}(\theta_2^3 - \theta_1^3)$$

The area will also equal the product of the mean ordinate and the temp rature difference, *i.e.*, $k_m(\theta_2 - \theta_1)$ where k_m is the mean conductivity in the range θ_1 to θ_2.

$$\text{Then } k_m(\theta_2 - \theta_1) = a(\theta_2 - \theta_1) + \frac{b}{2}(\theta_2^2 - \theta_1^2) + \frac{c}{3}(\theta_2^3 - \theta_1^3)$$

$$\text{or } k_m = a + \frac{b}{2}(\theta_2 + \theta_1) + \frac{c}{3}\left(\frac{\theta_2^3 - \theta_1^3}{\theta_2 - \theta_1}\right) \quad \ldots\ldots\ldots (2)$$

$$\text{when } k_\theta = a + b\theta + c\theta^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The curves given in Fig. 4 show how the conductivities of the magnesia (II.) and fireclay (I.) bricks studied vary with temperatures. The curve for silica does not differ much from No. 1 over the range studied. Each cross represents the experimental values of the average conductivity over a range of

TABLE 1.

Specimen.	Chem. analysis.	Thickness.	Apparent sp. gr.	True sp. gr.	P_a	P_b	Temp. range of measurement. Lower surface.	Upper surface.	Mean k.	Remarks.
Fireclay brick (Farnley)	SiO_2 66·0	1½"	1·95	2·54	23·3%	30·3%	825°	260°	0·0029	Hard fired to Seger cone 10—11 approxim't'ly
	Al_2O_3 31·0						970°	300°	0·0029	
	Fe_2O_3 1·2						1080°	330°	0·0036	
	CaO 0·3						1440°	550°	0·0040	
	MgO 0·9	1½"					1100°	420°	0·0033	another specimen
	Alk. 1·0						1350°	510°	0·0039	
Fireclay brick (Farnley)	as above	1½"	1·90	2·67	28·7%	40·4%	1005°		0·00165	Soft fired to Seger cone 8—9 approxim't'ly
							1020°		0·00120	
Silicious brick (Farnley)	SiO_2 82·5	3"	1·82	2·53	28·2%	39·3%	1500°	310°	0·0025	With many silica grains
	Al_2O_3 16·1									
	Fe_2O_3 1·2									
	CaO & MgO Tr.									
	Alk. 1·3									
Silica brick (Gregory)	SiO_2 95·3	2½"	1·75	2·32	24·6%	32·6%	1240°	440°	0·0039	
	Al_2O_3 2·0									
	FeO_4 1·1	2½"	1·74	2·32	24·8%		965°	295°	0·0030	Another specimen.
	CaO 1·5									
							1210°	370°	0·0035	Both coarse grained.
							1395°	440°	0·0042	
Magnesia brick (Mabor)	SiO_2 5·0	2½"	2·40	3·51	31·4%	45·9%	380°	270°	0·0170	Finer grained than the above.
	Al_2O_3 0·4						560°	325°	0·0151	
	Fe_2O_3 1·6						600°	400°	0·0148	
	CaO 1·7						700°	450°	0·0132	
	MgO 92·1						750°	470°	0·0116	
							875°	525°	0·0110	
							1025°	580°	0·0101	
							1040°	590°	0·0098	
							1370°	690°	0·0091	

The chemical analysis and porosity data were not derived from measurements on the actual test brick but on similar specimens of the same make. They will correspond approximately with those of the test bricks.

The experimental values obtained by the method described in this paper are for mean conductivities, *i.e.*, they are calculated on the supposition that the conductivity remains constant over the temperature interval in question, and the values have no precise meaning apart from the temperature limits. It was, however, desirable to know how the conductivity actually varies with temperature so that the true conductivity at a given temperature could be ascertained from our results.

The relation between the true and mean conductivities can be stated as follows:—Let the true conductivity at $\theta°$ C., k_θ, vary with temperature as shown in the curve in Fig. 3, when $k_\theta = a + b\theta + c\theta^2$. When ordinates are raised at temperature, the mean point of which is shown in the abscissa. If this range of temperature be not excessive so that the conductivity may be taken as fairly constant over it, then these values will approximate to the true conductivities at the temperatures given.

By inserting the experimental numbers into equation 2 and solving for 3 cases, the values of a, b, and c have been deduced and thence the equation connecting the true conductivity with temperature. For the magnesia brick it is:—

$$k_\theta = 0{\cdot}0285 - 0{\cdot}379 \times 10^{-4}\,\theta + 0{\cdot}179 \times 10^{-7}\theta^2$$

This equation approximates closely to the curve II. in fig. 4.

The variation in the case of the fireclay brick may be taken as linear and similarly :—

$$k_{\theta}=0{\cdot}00155+0{\cdot}25\times10^{-5}\theta$$

These curves show in striking contrast the influence of temperature on the conductivities of

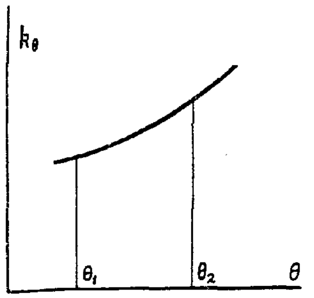

FIG. 3.

magnesia and fireclay. The apparently linear increase found in the latter case appears to be quite normal and usual in refractory materials. It is therefore difficult to account for the fall in the conductivity of magnesia at higher temperatures, although from our experiments there seems to be no doubt about it. Goerens (*loc. cit.*) found a similar fall in his experiments made on a magnesia brick richer in iron oxide than the one we used and probably denser. Even at the high temperatures, however, the conductivity of magnesia bricks is much greater than that of fireclay.

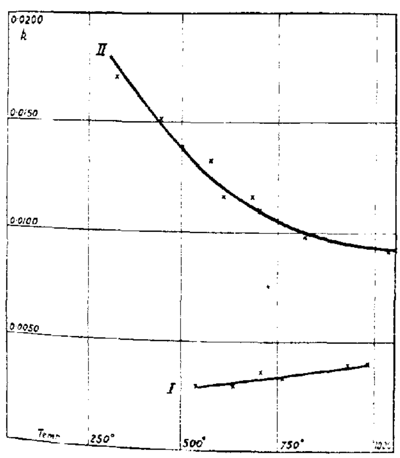

FIG. 4.

The variations of conductivity with temperature in the case of silica and silicious bricks are of particular interest in view of the growing importance of these refractories, but the data accumulated are as yet insufficient to allow definite conclusions. Some typical values are given for these materials and, as will be seen, they do not differ considerably from those of fireclay, although silica appears to have the slightly higher conductivity. The low value for the "soft fired" brick calls attention to the desirability of high temperature kilning where rapid heat transmission is important.

Thermal resistance of a joint.

In the construction of furnaces, the character and thickness of the joints of the brickwork may exercise a considerable influence on the transmission of heat, especially when the joint is disposed at right angles to the direction of heat flow. How great this influence may be in any particular case will depend on the nature and porosity of the jointing material. Experiments were made to get an idea of the thermal resistances of joints. The experiments, which were of a preliminary character only, indicated that the conductivity of the joint was of the order of one-tenth of that of the bricks.

Porosity.

It is well known that the transmission of heat by refractory materials is impaired by porosity, and heat-insulating materials are frequently rendered porous intentionally. It has been suggested recently by Mellor (J. of Gas Lighting, Mar. 10, 1914) that the heat insulating properties of pores will vanish at high temperatures, on account of the increase in importance of the radiation of heat across them, with rise of temperature, as compared with the conduction of heat through the solid material. This is doubtless true in part, because the rate of transmission of heat by radiation across a pore is, by Stefan's law, proportional to the difference in the fourth power of the temperatures, whereas the conductivity in the solid depends on simple temperature differences. Mellor, apparently overlooking the influence of the size of the pores and intervening solid grains, calculated that the rate of radiation across a pore would equal the rate of conduction through the solid at a red heat. The size—and also shape—of the solid grains and pores is, however, very important, because it determines largely the rate of conduction through the solid but does not affect the rate of radiation across pores. Taking this into consideration for pores of the size usual in refractory materials, it may be calculated that only at temperatures of several thousands of degrees does radiation become of the same importance as conduction. Thus, suppose we compare the transmission of heat across a parallel-faced slab of solid material 0·01 cm. thick by conduction and the transmission by radiation across a similarly shaped air space, when the two parallel faces are in each case at $T_1°$ and $T_2°$ absolute. The quantity of heat transmitted by conduction across the solid per sq. cm. per second equals $100k\ (T_2—T_1)$ cals. and by radiation across the pore :—

$1{\cdot}26\times10^{-12}(T_1^4—T_2^4)$ cals., where $1{\cdot}26\times10^{-12}$ is the constant of the Stefan-Boltzmann equation.

When the transmission of heat by radiation has become equal to that by conduction we can equate these, giving :—

$$100k(T_2-T_1)=1{\cdot}26\times10^{-12}\left(T_2^4-T_1^4\right) \quad\ldots\ldots\ldots\ (4)$$

It is easy to calculate, from equation 4, at what order of temperature the transmission of heat across a pore by radiation would become equal to that through a solid grain of the same size—say 0·01 cm.—by conduction, bearing in mind that T_2-T_1 would be very small compared with either T_2 or T_1. Calling $(T_2—T_1)$ ΔT, then :

$$\frac{k}{0{\cdot}01}\Delta T=1{\cdot}26\times10^{-12}[(T_1+\Delta T)^4-T_1^4] \quad\ldots\ldots\ (5)$$

$$=1{\cdot}26\times10^{-12}\times4\,\Delta T{\cdot}T_1^3 \text{ when higher terms of } \Delta T \text{ are neglected.}$$

$$\therefore T_1^3=\frac{k\times10^{12}}{0{\cdot}01\times1{\cdot}26\times4}, \text{ whence assuming } k=0{\cdot}003$$

$$T_1=3910° \text{ abs.}$$

The true value for k for the solid material of the brick will be greater than 0·003, and if that

were inserted, then still higher values of T_1 would be found.

The average pore diameter in a refractory material is, of course, much less than 0·01 cm., so that only at temperatures far above the melting points of refractory materials does the heat insulating effect of pores vanish, and porosity increases the heat insulating effect at all temperatures in use. Moreover, the smaller the size of the pores in the direction of heat transmission, the greater is the heat insulating effect for the same actual pore space.

The absolute temperature at which the breakdown of insulation by pores in any material occurs is given by an expression got by modification of equation 5 :—

$$T = 10^4 \sqrt[3]{\frac{k}{5d}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

where d is the pore or grain diameter and k the conductivity of the solid material.

The ratio, r, of heat conducted by a solid grain to that radiated across a pore is given by

$$r = \frac{2k \times 10^{11}}{d\,T^3}$$

The size of the space has then an important influence, and if it were of the order of 1 cm. in thickness, then Mellor's conclusion would be sound, and with T_2 and T_1 differing by 100° C. at a red heat, the transmission by radiation would become of the same order of magnitude as that by conduction across the solid.

While this does not apply, as has been shown, to the ordinary pores of a brick, yet it has considerable practical importance in other directions. It shows the limitations of the effectiveness of air spaces as heat insulators in furnace construction. It is clear from this calculation that at a red heat the radiation of heat across an air space would render it ineffective as a heat insulator, and that it would be better to fill the air space with solid material—for preference highly porous. Convection in the air space would also lower its insulating efficiency. That a loosely filled space is a better heat insulator at a high temperature than an empty one appears to have been verified experimentally by Ray (Fischer's Taschenbuch für Feuerungstechniker, p. 119) but we have had no opportunity of consulting the original.

Another interesting corollary to these considerations is that if radiation across pores is negligible at all ordinarily attainable temperatures, it cannot operate in causing the rise of thermal conductivity with temperature occurring in most refractory materials. The abnormality of magnesia confirms this, suggesting that the variation in conductivity is dependent on the nature of the solid material.

Diffusivity.

In all the measurements recorded in this paper the temperature conditions in the test brick have been steady. This answers to the definition of conductivity and is essential to the deduction of k by this method. But until such thermal equilibrium has been reached, the influence of heat conducted across the brick in causing a temperature rise is not determined by the conductivity solely, but also by the heat capacity per unit volume of the material—the greater the latter the smaller the temperature rise produced. In such cases, *i.e.*, in all heating-up operations, it is the "diffusivity" or "thermometric conductivity" with which we are concerned. This is the quotient of the thermal conductivity by the heat capacity per unit volume, or $\frac{k}{c\,s}$, where c is the specific heat and s the specific gravity of the material. The "diffusivity" in C. G. S. units measures the rise in temperature produced in 1 c.c. of the substance by 1 calorie flowing in one second through 1 sq. cm. of a layer 1 cm. thick having a temperature difference of 1° C. between its faces.

To compare the diffusivities of the materials used in these experiments it will be necessary to measure their specific heats, for the available data are very meagre. Heyn and Bauer give some specific heat measurements made on their materials, which will doubtless be approximately true for ours and serve to give an idea of relative diffusivities.

TABLE 2.

Material of brick.	Thermal conductivity.	Temp.	Specific gravity.	Specific heat.	Temperature diffusivity.
Fireclay .	0·0028	500° C.	1·95	0·23	0·0062
	0·0040	1000° C.		0·26	0·0079
Silica	0·0024	500° C.	1·74	0·26	0·0053
	0·0046	1000° C.		0·27	0·0098
Magnesia . .	0·0141	500° C.	2·40	0·26	0·0226
	0·0085	1000° C.		0·28	0·0126

The results we have obtained for silica and fireclay material do not disclose any appreciable difference in conductivity for lower temperatures, but at higher temperatures the thermal conductivity of silica seems to be rather greater. The difference in conductivity is emphasised if the fireclay material is soft-fired, which induces low conductivity. This is of some note. Gas retort material, for example, when the retort is made in one piece, is often soft-fired to maintain straightness of line in burning, although in high temperature carbonisation the harder firing may be effected in use, and the defect remedied. Built-up retorts have an advantage in this connection, as hard-fired bricks can be used. The temperature diffusivity of silica appears to be, at high temperatures, appreciably greater than that of fireclay materials, and in intermittent heating operations, including many carbonising processes, the changes of temperature in the refractory may be so considerable as to make this property of more importance than the thermal conductivity alone. It would seem desirable to investigate the point more closely. The high thermal capacity of magnesia moderates its diffusivity but still leaves it markedly superior to the other materials.

DISCUSSION.

Mr. F. W. RICHARDSON said that some years ago he had had to ascertain the conductivity of various packings for boilers, and he was surprised to find what a splendid non-conductor magnesia was. Had the authors considered the influence of the presence of iron oxide on the conductivity?

Mr. T. FAIRLEY asked whether the density of the bricks had been determined, and if the effect of subjecting them to high pressures had been studied. He thought the latter would reduce the size of the pores, and thus affect the conductivity.

Mr. C. P. FINN asked what was the influence on the conductivity of a coke oven wall, of the deposited carbon which permeated the joints and fireclay blocks after the ovens had been in use for some time.

Professor COBB, in reply, said that the excellence of porous light magnesia coverings for heat insulation and of hard calcined magnesia bricks for heat transmission, illustrated the impossibility of associating conductivity with chemical composition alone, and the necessity of considering physical constitution also. The influence of pressure in increasing the density of bricks by diminishing pore space was not so great as might be expected at first sight, for several reasons, but in so far as

pressure had that effect, it would presumably increase conductivity. Deposition of carbon in pores of brickwork would also in all probability increase conductivity unless a disintegrating effect accompanied it. Iron oxide if present in quantity would increase fusibility, shrinkage, and density on burning, and by lessening pore space would also be expected to increase conductivity.

Meeting held at The Queen's Hotel, Leeds, on Monday, April 19th, 1915.

MR. F. W. RICHARDSON IN THE CHAIR.

THE COMPOSITION OF SOME TYPES OF CHEMICAL GLASSWARE.

BY F. W. BRANSON, F.I.C.

The problems arising out of the present war as regards the supply of chemical glassware very soon became acute, owing to the fact that practically the whole of the glass apparatus used in this country was obtained from Continental sources, chiefly Germany and Austria. I therefore took early steps to ascertain by means of chemical analyses the composition of typical chemical glassware in general use (more particularly beakers and flasks) and miner's lamp glasses. The composition of these having been ascertained, it was possible to give manufacturers working formulæ in October last. In order to secure economy and facility of output, one glass—a zinc borosilicate—was selected for the manufacture of beakers and flasks which were by that time urgently needed, by Ordnance Works more especially. This glass has been adopted by the British Laboratory Ware Association, Ltd., as exhaustive tests have proved it to be similar to what was the best obtainable previously, namely, Jena "zinc borosilicate" glass. Reports on "B.L.W." glass from various expert and other sources (particularly from Ordnance Works) prove it to be, if carefully annealed, a reliable and economical substitute for the various types of chemical glassware previously in use. A 750 c.c. flask made from an early batch was reported on as follows on December 14th, 1914:—"About 250 c.c. of water was put in the flask and well boiled, then quickly cooled by holding under the tap. The water was boiled again and quickly poured out and cold water run into the flask whilst as hot as possible. About 10 grms. of drillings was dissolved in hydrochloric acid, evaporated to dryness, baked hard, cooled, and dissolved in hydrochloric acid. This was repeated three times. In the last case baking was continued for 1½ hours on the hottest plate. 300 c.c. of 20% caustic soda solution was put in the flask and kept at a steady boil for 2 hours. The soda was quickly poured out and the flask plunged under cold water. There was no indication of 'frosting' on drying the flask."

The constituents of a large number of glasses will be found in:—Thorpe's Dictionary of Applied Chemistry, Vol. 2, page 719, also in "Formulas for Glass Manufacture"* by the Institute of Chemistry, and in "Notes on Glass"† by the National Physical Laboratory.

The work I have carried out is partly covered by the "Notes on Glass" and "Formulas for Glass Manufacture" alluded to above, therefore I have not given any analytical data of glasses for which analyses have been recently published except in the case of Kavalier's potash-soda glass, which show the close similarity between the two analyses, the figures in the second column being those given in "Notes on Glass."

	%	%
SiO_2	75·96	76·02
Al_2O_3	0·40	0·64
Fe_2O_3	0·08	trace
CaO	8·48	7·38
MgO	0·14	0·30
K_2O	7·48	7·70
Na_2O	7·34	7·60
	99·88	99·64

This glassware was found to be next in order of merit to the Jena zinc boro-silicate glass, but owing to the war the supplies of potassium salts practically failed, therefore this type of glass was not recommended for manufacture. Experiments were also made (and are being continued) with a hard soda glass which works well in the blowpipe flame, the analysis being as follows:—SiO_2, 76·18%; Al_2O_3, 2·86; Fe_2O_3, 0·07; CaO, 4·52; MgO, 0·14; Na_2O, 16·43%.

No analyses were made of soft soda glasses, as these were already obtainable of British manufacture for the production of test tubes, etc.

Analyses were also made of two distinct types of glass combustion tubing. A Jena sample contained SiO_2, 66·90%; Al_2O_3, 6·38; Fe_2O_3, 0·22; BaO, 7·27; CaO, 7·94; MgO, 0·61; K_2O, 2·40; Na_2O, 1·25; B_2O_3, 7·22%.

The other type of combustion tubing (Kavalier) gave the following figures:—SiO_2, 79·57%; Al_2O_3, 0·32; Fe_2O_3, 0·038; CaO, 7·80; MgO, 0·11; K_2O, 11·60; Na_2O, 0·66%. The infusibility of this glass is due to the high percentage of silica present.

A further problem investigated was the miner's lamp glass, the Continental supply having practically ceased. So far as my knowledge goes the Jena miner's lamp glass was the best then in use, and the analysis of one specimen gave the following:—SiO_2, 73·08%; Al_2O_3, 1·98; Fe_2O_3, 0·15; CaO and MgO, traces; Na_2O, 7·76; B_2O_3, 17·22%.

With instructions as to procedure these figures were given to a manufacturer, but the glass was found difficult to work, being rather pasty, even at a high temperature. The working formula was then altered with much better results, and the lamp glasses will bear the Board of Trade test of immersing in cold water and raising to boiling point, continuing at that temperature for 20 minutes, then suddenly plunging the glass into cold water (temperature 15° C.); no fracture resulted. It is a very tough glass and is broken with difficulty, say by a miner's pick.

The sand used in my experiments was of French origin and almost entirely free from iron. The calcium carbonate and aluminium hydroxide were of British origin and were commercially pure.

The high temperature coke furnace I used for the experiments was a very convenient one for the purpose, as the temperature could be readily regulated up to white heat and each experiment could be carried out in duplicate under the same conditions, similar to those obtaining in glass works. Each melt could be started cold and continued at the desired temperature for many hours.

In conclusion I beg to express my indebtedness for analytical and other assistance to Mr. F. H. Branson and Mr. W. McD. Mackey.

DISCUSSION.

Mr. FRANK WOOD said that the great trouble in England was the shortage of labour: a long

* This Journal, April 30, 1915, pp. 424–5.
† This Journal, March 15, 1915, pp. 210–1.

training was necessary to produce an expert glassblower. He had been informed that if a glass contained arsenic, it became clouded with the repeated heating and cooling in working up in the blowpipe. He supposed arsenic was used because it cleared the molten glass of air bubbles and impurities, but this result could be obtained just as well by the use of ample time and heat. If sodium carbonate were used, the resulting glass was not so good as if the nitrate were used.

Mr. C. P. Finn asked whether there was any special process of annealing safety lamp glasses. He had seen glasses which fractured into pieces, only being held in place by the metal frame of the lamp. The nature of the fracture was similar to that of toughened glass or of a Rupert's drop.

The Chairman said that he supposed the glasses used in the electric lamps would have to be toughened.

Mr. Wood said that in the modern lamps the globe carrying the filament was surrounded by a separate globe of very thick glass. If that outer globe were broken, it automatically extinguished the light.

Mr. T. Fairley said that he had found that the moment the surface of toughened glass was fractured, the glass flew to pieces. The same thing happened if the outer surface were dissolved away in hydrofluoric acid. It appeared therefore that only the outer surface was toughened.

Mr. Frank Wood said that in the case of a doubtful looking apparatus it was very useful to re-anneal it by placing in a cold oil bath, and gradually heating to as high a temperature as was safe, afterwards allowing it to cool slowly.

Mr. F. W. Branson agreed with Mr. Wood that the presence of arsenic was objectionable and unnecessary. He considered that the use of a certain proportion of sodium nitrate in the manufacture of glass was an advantage. Pure alumina was very low in price and worked well. Several firms in this country manufactured miner's lamp glasses, and since the war certain tests had been somewhat relaxed by the Board of Trade. Some of the glasses were toughened by dipping in oil.

An extensive collection of British-made chemical glass and porcelain ware, nickel crucibles, filter-papers, etc., was exhibited by the British Laboratory Ware Association, Ltd.

THE ANALYSIS OF TANNING MATERIALS.

BY ALEXANDER T. HOUGH.

It is a recognised fact that the official method of analysis of the International Association of Leather Trades Chemists, even in its present improved form, leaves much to be desired from the point of view of accuracy.

Mr. Bennett's recent suggestions (this J., 1914, **33**, 1182, *seq.*), if finally adopted, will greatly enhance the value of the method, and it is to be regretted that the research work was not pushed to this point before the last change of method was made in 1907, as it was even then realised in which direction the present official method could be improved and made to give higher non-tannins.

The change which was then made reacted upon the trade inconveniently for some considerable time, owing to the apparent loss of tannin indicated by the new method; and at that time, if this loss had been still greater to the extent of the suggestions now made by Mr. Bennett, the resistance of the trade would probably not have been stronger.

The friction caused by the previous change of method passed, in England, in about a year. But on the Continent of Europe it was so great that the trade actually proved stronger than the chemists, and to this day, although the "shake" method is the official method of the I.A.L.T.C., it is only used on the Continent rarely, and by special request of the client; ordinarily the old filter bell method obtains, using dry chromed hide-powder.

It will certainly be difficult to impose a second and still more sweeping change than the last on the English trade, and it seems rather futile to force more changes upon our own people when the continental and American trades will not fall into line as they ought to do, for the improvements suggested are equally applicable to all present methods of tannin analysis, and if adopted in England only will put English traders to a serious disadvantage.

In Mr. Bennett's first paper there is, however, one statement which appears to be misleading: he says that by increasing the dilution of the extract solution the non-tannins are increased, and he quotes figures showing that by adding 100 c.c. of water to each 100 c.c. of tannin solution shaken with 26·5 grms. of wet chromed hide-powder, an increase of non-tannins is obtained.

Now although the experimental work is correct and higher non-tannins are actually obtained under these conditions, the higher non-tannins are not due to dilution of the solution, but to the fact that 26·5 grms. of hide-powder is now being used to detannise 200 c.c., whereas before, the same quantity was used to detannise 100 c.c. The concentration of the hide-powder has been decreased, and it cannot therefore do as much work in a specified time. If the quantity of tannin per litre of solution is decreased by 50%, and 100 c.c. be shaken with 26·5 grms. of wet chromed hide-powder, the non-tannin will actually be lower than with a stronger solution, for obviously, there being less tannin in the solution, it is more quickly absorbed, and the hide-powder subsequently commences to absorb the non-tannins. That this is a fact may be proved by experiment. The difference is not great, but that only proves the efficacy of chroming the hide-powder, one object of which is to reduce the absorption of non-tanning matters. Thus, by dilution of the tannin solution, lower non-tannins are obtained unless larger quantities of solution be used, or smaller quantities of hide-powder, and the same result may be obtained by increasing the strength of the solution of tannin. Actually it would seem best to use tannin solutions of the present official strength and reduce the quantity of hide-powder employed to such a point that detannisation is just effected.

Then again Mr. Bennett suggests that the reduction of the quantity of hide-powder employed may "involve some extension in the time of shaking." This seems as undesirable as it is unnecessary, for if changes are to be made, they should be as few as are necessary to obtain the desired degree of accuracy. Now the concentration of the tannin solution being constant, smaller quantities of hide-powder take longer to detannise, and *vice versâ*, since the present method uses a large excess of hide-powder, there is no need to alter both factors—hide-powder and time. The quantity of hide-powder should, as suggested, be reduced to such a point that it will do its work in the official ¼ hour. If the detannisation is not complete too little powder has been employed.

It thus appears that, so far as infusions of fresh tanning materials and solutions of tanning extracts are concerned, it is only desirable to change three factors, viz. :—(1) The acidity of the hide-powder before chroming, which should be reduced to *nil*

by extending the method suggested by Dr. Parker and myself (Collegium, 1908, No. 310; this J., 1908, 695). (2) The reduction of the quantity of hide-powder per "shake" to such a point that solutions of the present official strength are just detannised in ¼ hour. (3) The employment of a more basic chrome salt for chroming the hide-powder.

In regard to tannery liquors I can only endorse Mr. Bennett's statements and eulogise his suggestions, excepting that which mentions dilution of the solutions for the estimation of non-tannins, to which the arguments instanced above apply with even greater force, owing to the larger quantities of non-tannins and free organic acids contained in such solutions. Back tannery liquors are usually somewhere between N/50 to N/20 in volatile acids, and the tannin strength is often within the limits prescribed by Mr. Bennett, so that these liquors would seldom require dilution before analysis, and acid solutions of such a strength and in presence of so little tannin would certainly seriously influence results. It is certain that the hide-powder will primarily absorb the strong organic acids, thus automatically changing its condition and absorptive capacity before attacking the tannin.

I would suggest the possibility of reducing the acidity of all tannery liquors to some predetermined standard by first estimating the volatile acidity by the lime water method, or the concentration of the H-ions by means of the apparatus described by Wood, Sand, and Law (this J., 1911, 872), then adding sufficient standard soda to neutralise to a certain fixed point—such as will leave the solution slightly acid, in order to prevent oxidation—and afterwards detannising as suggested, but without further dilution. After detannisation one might add to the non-tannins sufficient tartaric acid to combine with the added soda, together with an excess of 25 mgrms., and correct for sodium tartrate and tartaric acid in the final result. This is in order to expel all volatile acids as suggested by Mr. Bennett.

The washing of the hide-powder has always been the *bête noire* of the "shake" method, and soon after the method was adopted in England it was suggested that this washing might be avoided by simply doing a blank test with distilled water and correcting the non-tannins by subtracting the residue thus found. A blank test with washed powder gives between 1 and 2 mgrms. of residue, mostly organic, per 50 c.c. evaporated. This residue precipitates tannin and is probably reduced to *nil* during shaking. The liquor squeezed from unwashed hide-powder, however, gives a flocculent precipitate with tannin, and 50 c.c. filtered and evaporated give a residue of about 223 mgrms., composed mostly of hydrolysed hide-substance or gelatones. In a blank test made with 26·5 grms. of wet, chromed, and unwashed hide-powder, shaken with 100 c.c. of distilled water, 50 c.c. of filtrate gave a residue of 32 mgrms.

On shaking this hide-powder with tan solutions, one would have expected these precipitable gelatones to have been thrown out of solution at first, and absorption of tannin by the hide-powder to have taken place secondarily. This, however, is not the case. By increasing the concentration of the tannin solutions shaken, the gelatones in the non-tannins decrease, as shown by the increasing feebleness of their reactions with tannin solutions and the decreasing differences between the residues yielded by washed and unwashed powders as the tannin strength advances (see table).

Eventually, by diminishing the hide-powder employed, or increasing the strength of tannin, one might arrive at a point where no further cloudiness would be shown by the non-tannins on addition of tannin, but as this point would be always doubtful, and a correction therefore always variable, it would seem useless to attempt to do tannin analyses with unwashed hide-powder.

Concentration of tan solution.	Washed hide-powder.	Unwashed hide-powder.	Difference.
	grms.	grms.	mgrms.
0·37%	0·0480	0·0600	12
0·185%	0·0230	0·0390	16
0·074%	0·0060	0·0280	22
distilled water	0·0020	0·0320	30

In the experiments shown in the above table, 100 c.c. of tan solution was shaken for ¼ hour with 26·5 grms. of wet chromed hide-powder—representing 6·5 grms. of dry hide-powder—and the residues given are on 50 c.c. of the resulting non-tannin, evaporated and dried.

THE ANALYSIS OF TANNING MATERIALS: A REPLY.

BY H. G. BENNETT.

(I.) Some criticism is offered by Mr. Hough on the writer's suggestion to increase the dilution at which detannisation is effected. The facts are, that when the same weight of hide-powder is used to absorb the same weight of tannin, in the same manner, an increase in the dilution of the tannin infusion results in a smaller absorption of non-tanning matters. It seems legitimate to conclude that the change in the experimental results is the effect of the one deliberate change in the method of analysis. Other factors being constant, the dilution and the non-tannin percentage are concomitant variations, and are therefore causally connected. It is difficult to see how Mr. Hough can avoid that conclusion, but it is even more difficult to understand his positive statement to the contrary, viz., "the higher non-tans are not due to the dilution of the solution."

Mr. Hough has apparently not realised that in experimenting on the effect of dilution, the ratio of the weight of hide-powder used to the weight of tannin used was constant; and that in experimenting on the effect of a lower proportion of hide-powder the dilution was kept constant. These are two different lines of experiment; the factors changed are fundamentally different, the results are affected to a different extent and for different reasons.

(II.) Mr. Hough also says that any extension in the time of shaking is "as undesirable as it is unnecessary." With this the writer is in full agreement. The method of procedure suggested has been used for over two years, and no extension of the time of shaking has ever been found necessary. Mr. Hough's quotation referred not to the revised method suggested, but to possible future experiments, the object of which was to ascertain the *smallest possible proportion* of hide-powder which could be used for complete detannisation. In employing 5 grms. of hide-powder per shake 15 minutes shaking is sufficient; but if it be desired to reduce the proportion of hide-powder to the absolute minimum, *the attainment of this minimum* may involve an extension in the time of shaking. It may yet be found that the minimum amount of hide-powder necessary for 15 minutes' shaking does not give a sufficiently accurate result.

The writer is of the opinion that further experiments in this direction are very desirable, the attainment of this minimum being conducive both to truth and to concordance. The lower the proportion of hide-powder, the less the method is dependent upon variations in its quality.

Chemical Society.

THE POSITION OF THE ORGANIC CHEMICAL INDUSTRY.

Presidential Address delivered at the Annual General Meeting of the Chemical Society, March 25th, 1915. By William Henry Perkin, Ph.D., Sc.D., LL.D., F.R.S. Chem. Soc. Trans., 1915, **107**, 557—578.

[Abstract.]

The critical condition of our textile and other industries as a result of the present lack of dyes is a vivid illustration of the fact that Germany has no competitor worth considering in the whole domain of organic chemical industry. That we should have allowed trades of such magnitude to pass almost completely into the hands of a foreign nation seems incredible, and we must take warning, and not allow, in the future, our industries to be controlled in this way by the foreigner, and to be in danger of being brought to a standstill.

The opportunity of establishing a great national industry, due to the discovery of the aniline dyes in this country, has been allowed to escape us, and various reasons have been put forward to explain the loss of the colour industry. One of the main reasons for our position is that we as a nation, and our manufacturers in particular, have failed to understand the extreme complexity of the scientific bais of organic chemical industry.

It has been urged repeatedly that our patent laws were greatly to blame, and that these laws were such that an English patent was no protection, and that so soon as anything new had been discovered in this country the Germans at once set to work to manufacture it. Even if this were true, and there may be some truth in it, it does not explain why the Germans were able to obtain their raw material as they did in this country, to transport it to Germany, and then to send the dye over here, and at the same time to make a handsome profit out of the transaction. Again, it has been urged that the obstacles to the use of pure alcohol which existed at the end of the last century played a great part in bringing about the decadence of the coal-tar colour industry in this country. Possibly there has been some hardship in special cases, but the assertion that the coal-tar industry has been lost to this country on account of these obstacles has been proved to be devoid of substantial foundation. Of late years the restrictions on the use of duty-free alcohol have been so relaxed and the denaturants which may be employed are of such a wide range, including as they do the actual articles to be manufactured, that there is probably at the present time less difficulty put in the way of the manufacturer here than is the case in Germany.

It is quite obvious that other reasons than those just mentioned must be found to account for the gradual transference of the coal-tar industry to Germany. The decadence of this industry and its gradual transference to Germany may be said to have begun during the period 1870-75. It was in 1874 that the works of Perkin and Sons at Greenford Green was sold to the firm of Brooke, Simpson, and Spiller, and these works were then in the most prosperous condition, and much in advance of anything that existed in Germany. One reason for the sale was my father's natural dislike to an industrial career, and his desire to devote himself entirely to pure chemistry. There was, however, a much more weighty consideration which played the really important part in his decision to dispose of the works. It was recognised that the works could not be carried on successfully in competition with the rising industry in Germany unless a number of first-rate chemists could be obtained and employed in developing the existing processes, and more particularly in the all-important work of making new discoveries. Inquiries were made at many of the British universities in the hope of discovering young men trained in the methods of organic chemistry, but in vain. The manufacturer of organic colouring matters during the critical years 1870-80 was, owing to the neglect of organic chemistry by our universities, placed in a very difficult and practically impossible position. At that time organic chemistry was not recognised by the older universities, and the newer universities, which have since done so much for the progress of science, had not come into existence. It is surely remarkable that the study of so important a subject as organic chemistry should not only have been practically ignored by our universities in the past, but that even at the present day it does not flourish in the way it does in almost every university and technical school in Germany.

So soon as the importance of organic chemistry became apparent, great teachers, such as Liebig and Wöhler, Kekulé and Baeyer, founded schools in Germany specially devoted to the subject, and they and their pupils then began to publish that wonderful series of classical investigations which laid the foundations on which the superstructure has since been raised.

The value of the example of these great teachers and of the system of research which they had initiated soon became generally appreciated by the universities in Germany, and every effort was made, by the establishment of laboratories supported by adequate grants from the various States, to help forward the new movement. The step which, in my opinion, did more than anything else to bring about the wonderful development of organic chemistry in Germany was the provision that research must be an essential part in the training of every German student of chemistry. Every student is brought into contact with research as a matter of course, and it is made quite clear to him, directly and indirectly, that his future career as a teacher or as a works chemist depends mainly on his ability as an investigator.

Since the necessity for research as an essential part of the training of the science student in this country is not insisted on, it is not surprising that the output of original work has in the past been small compared with that of Germany, and that the supply of able research chemists is so limited. I suggest that the German system is, in this respect, worth copying, and that the B.Sc. degree of our universities, and certainly the B.Sc. with Honours, should not be conferred except on those who have gone through a course of research as an essential part of their training. A change in this direction would ensure that a supply of first-rate chemical ability was always available to assist in the development of the industries of the country. If the universities of our country had, at the time the Greenford Green works changed hands and for some years afterwards, trained able research chemists and placed them at the disposal of the manufacturer, there can be no doubt that these works, as well as others, would still be in existence and flourishing, and that we should have kept the coal-tar colour industry here, and it is precisely for this reason that I express the opinion that the universities, more perhaps than the manufacturers, were to blame for the loss of the industry.

In almost every direction, and to a far greater extent than has been the case in any other country, Germany has recognised the value of the closest possible contact between the industries and the universities. In Germany the majority of the professors and Privatdocenten are in close touch with the large factories, and spend part of their time in solving technical problems which they may either devise themselves or which

submitted to them by the manufacturer. I have it on the authority of several of the best-known directors of German works that the atmosphere of the university laboratory is much more suitable for discovery than that of the works, and that, as a fact, many of the most valuable discoveries which subsequently proved to be of the highest technical importance have been made in university laboratories and transferred to the works. Close association of the universities with the industries does not exist to any extent in this country, and is one of the things we have to aim at in the future. It must be of great advantage to industry, and cannot fail to be of great value also to the university, for it must result in the manufacturer taking a keen interest in the welfare of the department with which he is associated. Contact with the research department of a large works must always be stimulating; problems are encountered, many of them of great scientific interest, which would never suggest themselves in strictly academic circumstances, and as one of the results, the tendency, which is always present under existing university conditions, for the professor to become an academic fossil and unproductive, is postponed. Again, contact with the research departments of a flourishing works cannot fail to suggest subjects for investigation which are eminently suitable to occupy the attention of research students, many of whom will ultimately take up technical work. I look forward to the time when the scientific staffs of our universities and technical schools will not only be available for industrial research, but will be encouraged by those in authority to undertake such work.

I am convinced that, when the new development has been given a fair trial, the difficulties which some are inclined to urge against it will be found to be more apparent than real. While, then, I have been pleading for closer contact between the universities and the industries, and have suggested that the existence of such an alliance has been an important factor in the development of the vast organic chemical industry in Germany, it must be remembered that many other influences have been at work to bring about this result.

It is because we have left the coal-tar colour industry to Germany, that we find ourselves in the present grave and serious position. If we accept the enormous technical importance of organic chemistry, and decide that we are not going to allow all this wealth and prosperity to pass entirely into the hands of a foreign country, our manufacturers must, in the first place, make up their minds so to conduct their works that research is going on unceasingly; no works can possibly flourish which is content to manufacture only well-known colours, and it is only by the discovery of new colours and other products that manufacturers can hope to get a satisfactory return on their capital. The manufacturer must therefore see that his laboratories are properly equipped, and well supplied with research chemists of ability who have had a sound scientific training, and also some experience in the methods of research. All this, however, will avail little unless he has a scientific leader in his works who is able to direct the investigations of his young staff in the right channels.

So far as I am aware, there is not a single colour works in this country which has a really brilliant scientific head; by which I mean a chemist of wide scientific experience, and with the knowledge and ability to direct research, and this is a very serious state of things, and quite incompatible with chemical efficiency.

I have long thought that the want of an able scientific head is one of the most obvious reasons why our colour works are in such an unsatisfactory condition. The success of a business based on science must often be essentially the work of a single, brilliant, scientific man. If a works is fortunate enough to have the services of a distinguished scientific man, capable of initiating and carrying out original investigations, and who will not only be constantly making discoveries himself, but be able at the same time so to influence his young staff that they will follow in his footsteps, the success of such a works can never be in doubt. I am afraid, however, that it will be a long time before we can hope that our manufacturers will give up their old-fashioned rule of thumb methods and fully grasp the truth of this vital matter.

My experience of the manufacturer in this country is that he is usually merely a commercial person who does not like the expert, and especially the idea of giving the expert a prominent position in the control of his works. Possibly the reason in many cases is ignorance of the value of science, but more probably it is due to the fact that being ignorant of science himself, he feels that if the expert is given too much prominence he must either study himself in order to understand the expert or leave the essential control of the business in his hands. Both these courses are distasteful to the ordinary commercial member of a board of directors; the expert is therefore relegated to the background, and the business comes to grief.

It is scarcely necessary to point out that, if a chemical works is to be successful, the first essential is that it must be under chemical control, and that every department must be in the hands of an expert; the board of directors may then be a mixed board, provided that steps are taken to ensure that chemical opinion is largely represented on it. The recognition of the soundness of this principle is one of the main reasons for the success of the German works.

Let us assume that the necessity for the chemical control of a chemical works is conceded, and that it is clearly understood that the next step is the discovery of improvements in every direction, such as the invention of dyes better than those already known, and the economical development of essential existing processes, then the first thing to be done will be for our universities to set to work to educate a supply of organic research chemists who will be able to undertake this work. This will mean that organic chemistry will have to flourish to a much greater extent than it does now, because the supply of organic research chemists available under ordinary conditions is a very small one, and scarcely sufficient to meet even the moderate demand which exists at the present time. Those of our students who wish to become successful organic chemists must radically alter their methods, and devote more energy and concentration to the mastery of the literature of the subject, and particularly must spend much more time than they do now in the laboratory in order that they may acquire real skill, and get a thorough working knowledge of the essential processes connected with the complex and difficult technique of organic chemistry.

Probably, if there were a closer connection between the industries and the universities, students would more quickly appreciate the great amount of theoretical study, practical ability, and originality which is indispensable to the making of a successful research chemist for an organic chemical works, and recognise that the requisite technique can only be acquired as the result of long hours in the laboratory.

If the effort gradually to develop—it is not a question of immediately establishing—a thriving organic chemical industry in this country is to be

seriously taken in hand, and if the requisite capital is forthcoming, it is obvious that what will be required before everything else will be a really able chemical staff, and there should, therefore, be a great opening in the near future for young organic chemists of ability.

Soon after the outbreak of the war, a Board of Trade Committee was appointed, with instructions to consider the best means of obtaining for the use of British industry sufficient supplies of chemical products, and, after hearing the evidence of many of the more important producers and consumers, a small Committee was charged with the task of sifting the mass of evidence which had come forward. As the result of the report of this Sub-Committee to the larger body, a meeting of representatives of industrial firms and associations was held on December 10th at the Board of Trade, when a committee was appointed, and shortly afterwards recommended a scheme which involved the formation of a joint stock company, having for its object the manufacture and supply of synthetic colours. Subsequently, the Government announced that they were prepared to assist such an effort (see this J., 1915, 22). Neither the Board of Trade Committee nor the Sub-Committee had anything whatever to do with the preparation of the scheme, and it is certainly extraordinary that a Committee consisting entirely of business men, and which did not include a single chemical expert, should have been entrusted with the formulation of a scheme for the founding and developing of a chemical industry. Had a chemical expert been present I venture to think that such a scheme would never have been placed before the public. It is stated in the Memorandum of Agreement attached to the scheme that the Company has been incorporated for the purpose, among other things, of manufacturing and selling dyes, colours, and other chemical substances, which, previously to the war, were exclusively or principally manufactured in Germany, and no mention is made of what ought to be the main object of such a company, namely, the employment of a large staff of research chemists under leaders of ability for the purpose of making new discoveries in every possible direction.

It cannot be too strongly emphasised that it is not merely a question of producing the dyes which are required during the war; any company which is formed must be established in so strong a position that it can expect to deal successfully with the keen competition which will be waged with the greatest severity by the Germans after the war.

The promoters of the scheme do not appear to have appreciated the difficulties of the situation, and obviously think that the manufacture of dyes in this country which previous to the war had been invented and produced in Germany is a matter which can quite easily be managed. It seems to be imagined in many quarters that, in order to manufacture a dye which had previously been made in Germany, all that is necessary is to follow the directions given in the patent dealing with that particular dye. No greater mistake could possibly be made. It is common knowledge that German manufacturers have for many years devoted large sums to the establishment of an efficient staff of patent experts, whose business it is so to word a patent that, whilst it satisfies the requirements of the patent laws of the various countries in which it is taken out, it only gives such information as is absolutely necessary, and contains no indication of the process which is used in the actual manufacture. In many cases patents are devised which are of no practical value, and are merely intended to mislead and throw competitors on the wrong scent. The discovery of the most efficient method of working patented processes is therefore often a matter of great experimental difficulty, and may require many months of research. Any new company started with the object of manufacturing dyes which previously to the war had been made exclusively in Germany must therefore be prepared to employ a large staff of research chemists for a long period without any prospect of return in the way of dividends.

Further, it must always be remembered that the Germans have many years' start of the new Company, and have accumulated such vast experience of methods of manufacture, and more particularly of the recovery and economical use of by-products, that they are able to sell at a profit at very low prices. What the new Company has to face is, therefore, in the first place, the problem of working out methods of manufacture and the utilisation of by-products until they have arrived at the same state of efficiency as the Germans, and that may be a matter of years. While this is being done, the new Company must also be busily engaged in training a large body of research chemists under the supervision of capable scientific leaders, so that the works may develop in as many new directions as possible, because the Company can only hope for permanent success if it pursues a policy of discovery and invention. Another point has also to be borne in mind, and that is that the Germans supply dyes and other products, not only to this country, but to practically all the other nations, and, in the event of a new company being formed on such large lines that it might prove to be a serious competitor, a German works could well afford to sell at cost price or at a loss in this country and make its profits in other lands until the new company had been ruined. Lastly, if we are to be allowed to make dyes, etc., during the war according to patents belonging to the Germans, what is to happen after the war? Will the Company be still allowed to use these patented processes, or will the patents again become the sole property of the Germans, and be workable in this country only on the payment of royalties or licences?

Although it is a matter of so much congratulation that the Government, which in past years has paid practically no attention to science and the application of science to industry, should, at last, have recognised the necessity for intervening and in no uncertain fashion, I have been forced to the conclusion, largely for the reasons which I have just stated, that the Company founded on the lines of this first Government scheme could not be expected to be successful in achieving the object which we all have so much at heart, namely, the recovery and development of the organic chemical industry in this country. Since the application for shares in the proposed Company was quite insufficient, the Government withdrew the scheme, and substituted for it an amended proposal, which is certainly in some respects an improvement (see this J., 1915, 133).

The amended proposal is another proof of the determination of the Government to meet the criticisms which were raised against the first scheme in a generous spirit, and to do all it possibly can to assist the efforts of the manufacturers in this country to place the organic chemical industry on a firm basis.

The grant for scientific research may be welcomed as a satisfactory addition to the old proposal, mainly because it shows that the Committee of users of dyes have at last found out that research is necessary if the new Company is to be a success. My own feeling, however, is that the Company ought to provide for research out of its

ordinary capital as a matter of course, and should not require a special subsidy for this purpose.

A much better plan, I venture to think, would be to employ this grant to subsidise the research laboratories of those universities and technical schools which are willing to specialise in organic chemistry, and are prepared to train a certain number of research students with the definite view of their subsequently entering the service of the new company. Supposing the new company were to adopt the view that closer connection between the universities and the industries is most desirable, and were to work in conjunction with the staffs of some of the leading organic schools, it is quite obvious that the knowledge of the needs of the works which would result from this connection would enable the staff to supply research students of exactly the type required by the works. Such research students would have been trained under the best scientific supervision which the country can provide, and at the same time they would enter the works with a considerable knowledge of the application of organic chemistry to technical operations, and be in a position to tackle with success research problems connected with new discoveries and new developments in the works. The plan of training research students under these conditions is, as I have already pointed out, the one which has long been adopted with such extraordinary success in Germany, and the large subsidies which the various States place at the disposal of their universities allow of the purchase of expensive apparatus and appliances which are outside the inadequate resources of most of the university laboratories of this country.

With regard to the kind of works it is proposed to organise for the manufacture of dyestuffs, etc., it would be well carefully to consider the policy which the Germans have adopted with so much success in the matter of the construction and arrangement of their works. One of the things which must strike a visitor to a great German works more perhaps than any other is the order and cleanliness which reigns everywhere, and the obvious care which is taken that every manufacturing operation shall be efficient in every detail. This order and cleanliness is not confined to the section of the works which deals with organic products; the same state of things is to be observed in every part, as, for example, in the case of the large plants which deal with the manufacture of sulphuric acid, nitric acid, and other inorganic products. Perhaps the idea which is conveyed most vividly by works such as these, all of which are concerned with the manufacture of a very large number of products of widely different character, is that they are, after all, merely laboratories on a larger scale. A very different impression is got by an inspection of many of the colour works in this country, and it seems to me very doubtful policy to suggest the possibility of the acquisition of works of this kind, which are obviously not efficient, and could only be made so by pulling down and re-building. It may be said that the most efficient only will be taken over, but selection will be found most difficult, because, if the new company proves a success, great pressure will be exerted by existing works in order to enter the charmed circle, and the argument of unfair competition will be used for all it is worth, and will be very difficult to deal with. Again, the experience of the Germans is all in favour of building up very large works, and against spreading manufacturing operations over small works situated in different parts of the country.

The reason for this is obvious. In the manufacture of any substance, by-products are almost always produced which must either be recovered or used in the manufacture of other saleable products; otherwise serious loss is inevitable. It is exactly in this respect that the Germans are so efficient, and the wonderful organisation which enables them to dovetail one process into another is one of the reasons why the comparatively small works in this country find it impossible to compete with them even in the manufacture of such simple substances as salicylic acid or β-naphthol. In order that by-products may be used to the best advantage it is obviously essential that all these dovetailing operations must be carried out on the same site, so that it may not be necessary to transport the by-products from one works to another, an operation which could not fail to entail loss. Probably the best course for the new company is either greatly to enlarge the works of Messrs. Read Holliday and Sons, or, if it is difficult to find space for this purpose in Huddersfield, to take steps to acquire a suitable site and erect and equip works thereon, a plan which is mentioned in the explanatory statement as one of the objects of the new company.

Let us suppose that, in the near future, a practically new works is built on a large scale, and with all the most modern appliances, and that the control of the whole works and of the different departments is placed in the hands of efficient chemical leaders with adequate staffs of chemists under their charge, and that the company has also large and well-equipped research laboratories busily engaged in discovering new developments and improvements on existing processes; what prospect has such a works of competing successfully with the existing German organisations and of obtaining a fair share of the organic chemical industry?

If we suppose that the German companies will continue to work with the same efficiency as before, or will rapidly regain that efficiency, I am inclined to think that we must be prepared to face the certainty that some years must elapse before we can compete successfully against organisations which have taken years to develop and bring to perfection. Many of us hold the view that, in order to prevent underselling and other unfair methods of competition, the Government ought to protect the new venture for ten years at least by placing an import duty of not less than 25 per cent. on all German dyes and other organic products. I hold the view that this, or prohibition for a time, is the only real solution of the difficulty, and if it should be found that this course leads to slackness and rule of thumb methods, and that the works, after their period of protection, have not developed on the lines of discovery and invention, then the Government will at least have the satisfaction of knowing that everything has been done on their part to establish the industry.

Failure to develop on research lines is scarcely conceivable if the works is in charge of a highly-trained chemical staff, but, on the other hand, if it gets into the power of the business man who wants an immediate return for his outlay, is not willing to wait for results, and fails to appreciate the importance of scientific control, then no tariff can avert disaster.

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I.—GENERAL PLANT; MACHINERY.

[*Corrosion due to*] *occurrence of chlorine in coal*. De Waele. *See* IIA.

PATENTS.

Grinding or crushing machinery. A. H. Moss. Gainsborough. Eng. Pat. 3258, Feb. 7, 1914.

A HORIZONTAL grinding ring having a concave upper surface is supported on three or more rollers, and one or more grinding rollers on swivelling shafts are pressed into contact with the ring by means of a wire rope, which passes over the swivelling shafts, and has a weight attached to its free end. The machine is enclosed in a casing through which a current of air may be passed.—W. H. C.

Crushing, pulverising, and disintegrating apparatus. F. Mansfield. Liverpool. Eng. Pat. 7391. March 24. 1914.

To facilitate replacement of the hammers and grid bars of a disintegrator, the hammer shafts have a slight end play relatively to the discs in which they are mounted. An aperture is formed in the side wall of the machine at the end of the curved sweep of bars; the bars are introduced through this opening and moved round into position, and then a longer end bar is inserted and pressed against the other bars by means of bolts. At the base of the feed hopper is a dispersing rib to deflect the material away from the central zone into the grinding or pulverising zone.—W. H. C.

Pulverising machines; Laboratory ——. F. C. W. Ingle. Johannesburg. Transvaal. Eng. Pat. 10,522. April 28, 1914.

THE interiors of the casing of the grinding chamber and of the feed and discharge chambers are constructed so as to have continuous curved surfaces, without any projections upon which dust can accumulate.—W. H. C.

Roll-mill for hard materials. H. Aldehoff. Berlin. U.S. Pat. 1,133,212, March 23, 1915. Date of appl., Jan. 19, 1914.

THREE grinding rolls are mounted in a triangular form within a grinding ring, which is supported by the upper grinding roll. A sloping guide plate between the lower rolls directs the material from the rolls towards sieve plates attached to the sides of the grinding ring.—W. H. C.

Pulveriser with rotary sieve. A. Weidknecht. Fr. Pat. 473,173, June 9, 1914.

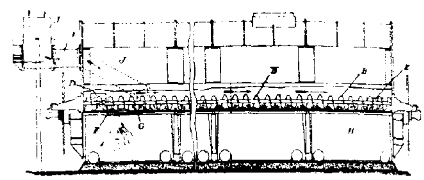
THE material is fed into the upper of two superposed horizontal grinding chambers, and after receiving a preliminary grinding, passes into the larger, lower chamber. The ground material is discharged from the lower chamber into a cylindrical sieve rotating about a horizontal axis. The finer portion of the material passes through the sieve and is collected, whilst the coarser particles are carried by horizontal blades fixed at intervals round the inner periphery of the sieve to the highest point, and discharged into a shoot, from which they are carried back into the upper grinding chamber by a screw conveyor.—W. H. C.

Pumps [*for peat, sewage, etc.*]. The International Nitrogen and Power Co., Ltd., and O. D. Lucas, London. Eng. Pat. 4950, Feb. 25, 1914.

THE pump is provided with independent suction and delivery piston valves. The suction valve is operated mechanically and the delivery valve is opened by the pressure in the cylinder at the commencement of the stroke, being for this purpose connected with the cylinder by a by-pass.—W. H. C.

Drying machines. R., W. G., and F. R. Simon, Basford. Eng. Pat. 5647, March 5, 1914.

THE wet material is fed from the hopper, I, through the shoot, J, into a conduit parallel with the rotary dryer, H, and containing a rotary conveyor,



B, which conveys the material to the inlet opening, E, of the dryer. The dried material is discharged from the drying cylinder, partly through the opening, F, provided with a sieve with a sliding shutter, G, to regulate the proportion of dried material discharged, and partly through the opening, D, into the front end of the conveyor, whence it is carried forward and mixed with the wet material to facilitate drying.—W. H. C.

Drying apparatus. G. A. Mower, and Sturtevant Engineering Co., Ltd., London. Eng. Pat. 21,232, Dec. 17, 1914.

FANS are used in tunnel-drying apparatus between each stage to blow the air through a heater to the next stage. With this arrangement no baffles are required, thus leaving a clear passageway for the conveyors.—W. H. C.

Furnaces or kilns: Gas-fired ——. L. F. Tooth, London. Eng. Pat. 7632, Sept. 26, 1914. Addition to Eng. Pat. 1772, Jan. 22, 1913 (this J., 1914, 240).

THE burners are arranged in the floors of the combustion chambers, and the secondary air is preheated by passing through passages in the furnace walls. W. H. C.

Furnaces heated by gaseous or liquid fuel. L. F. Tooth, London. Eng. Pat. 8961, April 9, 1914.

THE horizontal furnace is of circular, square, or D-section, and burners for gaseous or liquid fuel enter it tangentially at one end. The combustion products pass through a ring of openings at the closed rear end, into a series of horizontal regenerator flues leading to the main outlet at the front of the furnace. A second set of flues may be arranged between the first set, the gases passing through the two sets in series. In a modification, the furnace is open and provided with burners at both ends, the outlets to the flues being at the centre.—W.F.F.

Furnace; Rotary ——. H. G. Akers, Toronto, Canada. U.S. Pat. 1,130,953, March 9, 1915. Date of appl., May 14, 1913.

THE furnace has a composite lining, the bottom part of one material and the top part of another, and has a flange at the discharge end to serve as a hearth. Means are provided for imparting an oscillating rotary movement to the furnace. —W. H. C.

Retort and furnace. G. Schwahn, St. Louis, Mo. U.S. Pat. 1,132,738, March 23, 1915. Date of appl., Aug. 27, 1914.

A RETORT having two vertical side-walls of large area, with a narrow intervening space, is enclosed within a furnace having double sets of flues for the combustible gases, one set on each side of the retort. The flues are preferably near the top or bottom of the retort, with outlet flues for the combustion products near the opposite extremity.
—F. SODN.

Kiln. J. N. Silva, Pueblo, Colo. U.S. Pat. 1,133,190, March 23, 1915. Date of appl., Nov. 13, 1912.

THE furnace grate is formed within the plane of the kiln wall and has an ash hopper below, from which the ashes are discharged through a valved shoot, into a pit formed on the ground outside the plane of the kiln wall. The valve is operated from above by means of a rod, and air is delivered below the grate from a main formed in the wall of the ash hopper.—W. H. C.

Metallic union. [*Surface-combustion furnace.*] W. McA. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 1,133,245, March 23, 1915. Date of appl., Dec. 8, 1914.

A MIXING chamber for the combustible gas communicates with a superposed chamber containing a bed of refractory material, by a number of tubes of refractory material which are supported by a metallic partition, and extend into the combustion bed. The metal of the partition is "amalgamated" with a film of metal deposited in the pores of the lower ends of the tubes.—W. F. F.

Separators: Planetary, centrifugal ——. W. Mauss, Johannesburg, Transvaal. Eng. Pat. 8767, April 7, 1914.

IN separators of the planetary type in which the separated solid matter is carried out of the separating zone by the slow rotation of the separating drums about their own axes, it has been found that as the deposit of solid matter approaches a position parallel with the direction of the centrifugal force, it tends to break up and roll back to the separating zone. To overcome this defect, a curved shield is fixed within each of the separating drums, so as to form, with the wall of the drum, an annular passage through which the separated solids pass to the point near the main axis, where they are removed by a plough and discharged through an opening in the bottom plate of the outer drum. "Adhesion rings" are provided on the inner side of the drums to assist in the transport of the separated solids to the separation zone. The drums are so disposed that they nearly touch the main axis.
—W. H. C.

Separator; Centrifugal ——. D. B. Weston, Sharon, and M. H. Barker, Boston, Mass. U.S. Pat. 1,132,814, March 23, 1915. Date of appl., May 9, 1911.

A PRESSURE-TIGHT chamber formed of two cones attached to one another at their wider ends and provided with hollow shafts attached to their narrower ends, is supported and rotated in a vertical position. Liquid enters the separator through one of the hollow shafts and leaves by the other, the separated material being discharged through ports formed in the periphery and provided with valves opening inwards and actuated by weighted levers.—W. H. C.

Separating solid particles from liquids by the combination of a centrifugal and filtering action. K. and A. Ward. Fr. Pat. 472,701, May 26, 1914. Under Int. Conv., May 29, 1913.

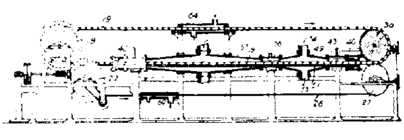
LIQUID passes through a hollow shaft to a revolving perforated drum, and the heavier solid particles are projected outwards through the wall of the drum into a surrounding stationary casing filled with liquid under pressure. The liquid, thus freed from heavier particles, passes inwards through the permeable wall of an inner concentric drum which retains the lighter particles, and is finally discharged through the hollow shaft. The filter may be cleaned by passing a current of clean liquid in the reverse direction.—W. F. F.

Lubricating packing; Process of making a ——. A. Barberis, Mexico City. Eng. Pat. 14,433, June 16, 1914.

COTTON or other fibrous waste is rendered incombustible by soaking it in a 10% solution of alum or other suitable salt; it is then squeezed, soaked in a mixture of water, 1,000 grms.; boric acid, 20; gelatin, 30; glycerin, 40; 30% solution of formaldehyde, 4, and number 00 graphite, 100 grms., again squeezed, and treated with a suitable proportion of lubricating oil.—W. H. C.

Filter-press. F. J. Wagner, Santa Ana, Cal. U.S. Pat. 1,119,736, Dec. 1, 1914. Date of appl., May 9, 1913.

THE endless belt, 26, formed of filtering material, and the linked conveyor chain, 19, pass respectively over the drums, 22, 27, 18, 30, in the direction



shown by the arrows. On coming into contact, as they leave the drums, 27, 30, they form together a continuous series of filter-cells enclosed by the links of the chain. These pass through the stuffing-box, 40, and the pressure-box, 43, into the filter-chamber, 49, into which the material to be filtered is introduced through the pipe, 54. The liquid passes through the band of filter cloth and through the perforated supporting plate, 51, and is discharged through the pipe, 55. The residue is carried by the chain and belt through the pressure-box, 56, and the washing chamber, 57, and the solid residue is discharged as the band passes over the drum, 22, any remaining particles being removed by the brush, 13. The band and the conveyor chain are washed in the washing boxes, 69, 64, respectively, on their way back to the drums, 27, 30.—W. H. C.

Filters; Plate ——. E. Simoneton. Fr. Pat. 473,187, Sept. 10, 1913.

A METALLIC ring fixed in the central aperture of the hollow disc or plate of porous material, is provided with openings for the filtrate having flanges which overlap the central portion of the disc. When the discs are mounted on a hollow central rod, all axial pressure is taken by the metal rings.—W. H. C.

Decolorising liquids: Method for ——. F. R. Bachler, Assignor to Kieselguhr Co. of America, Los Angeles, Cal. U.S. Pat. 1,131,308, March 9, 1915. Date of appl., Sept. 20, 1913.

LIQUIDS containing oxidisable colouring matter are mixed with hydrogen peroxide absorbed in finely-divided kieselguhr, and the mixture is heated.
—W. H. C.

Evaporator. R. R. Row, Jersey City, N.J. U.S. Pat. 1,131,738, March 16, 1915. Date of appl., June 7, 1912.

THE vertical heating coils of the evaporator are

mounted on a frame supported on a door which closes an opening in the side of the vertical evaporating chamber. The door and frame are mounted on rollers, so that the coils can be easily withdrawn from or returned to the ebullition chamber.—W. H. C.

Cooling, washing, and mixing gases; Apparatus for——. H. E. Theisen. Munich, Germany. U.S. Pat. 1,131,966, March 16, 1915. Date of appl., June 16, 1914.

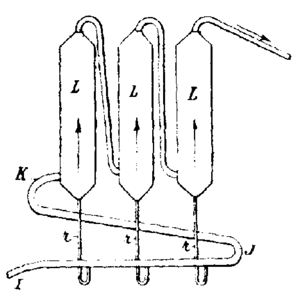
A SERIES of annular beaters, mounted on a central shaft, rotates within a casing, the upper part of which is concentric with the beaters, whilst the opposite walls of the lower portion gradually diverge. Washing liquid is supplied to the annular beaters, and the gas is introduced through the enlarged lower portion of the casing.—W. H. C.

Gas-currents; Trapping particles in suspension in ——. T. E. Murray and C. B. Grady, New York. U.S. Pats. (A) 1,132,677, and (B) 1,132,678, March 23, 1915. Dates of appl., March 28 and May 15, 1914.

(A) THE gas is supplied to a rotary fan wheel which delivers it radially outwards on to liquid retained by flanges at the lower edges of a curved plate forming a volute chamber around the wheel. The liquid is carried round the inner circumference of the plate in a thin film by the gas current, and discharged into a receptacle below the chamber. (B) The gas passes over a film of liquid running over a wooden plate.—W. F. F.

Distillation; [*Separation of vapours of*——]. E. A. R. Chenard. Third Addition, dated March 31, 1914, to Fr. Pat. 443,499, May 7, 1912 (see this J., 1912, 971 and 1913, 184, 249).

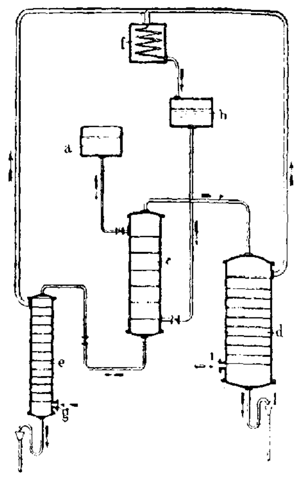
To separate vapours of different densities, the mixture is passed through the pipe, I, J, K, and the vessels, L, L, L, connected as shown (see fig.).



The heavier vapour sinks to the bottom of these vessels and that condensed returns by the pipes, *t*, to the pipe, I, J, where it is again vaporised. Alternatively the vessels, L, L, L, may be connected by pipes from the bottom of one to the top of the next.—W. F. F.

Mixtures of liquids; [*Extraction*] *apparatus for the separation of* —— *into two components.* K. Kubierschky. Fr. Pat. 472,560, May 22, 1914.

THE mixture of liquids (*e.g.*, a solution of aniline in water) flows from the tank, *a*, into the upper part of the column, *c*, and a solvent (*e.g.*, benzol) flows from the tank, *b*, into the lower part of the column, *c*, the proportions being regulated by the cocks (see fig.). The solvent rises through the heavier solution, dissolves the desired constituent, and passes in the direction indicated by the arrow, into the top of the column, *d*. Steam enters this column at *i*, and vaporises the benzol, which passes in the direction indicated by the arrow to the condenser, *f*. The aniline freed from benzol flows from the bottom of the column, *d*,



by the pipe, *l*. The exhausted liquid, which contains a little of the solvent, flows from the bottom of the column, *c*, into the column, *e*, where the benzol is distilled off by steam, which enters at *g*.—W. H. C.

Decantation; Apparatus for —— [*for bleaching liquor, etc.*]. A. Champ, Craponne, France. Eng. Pat. 25,112, Nov. 4, 1913. Under Int. Conv., Feb. 24, 1913.

SEE Fr. Pat. 454,751 of 1913; this J., 1913, 910.

Sizing or classifying comminuted material; Process of, and apparatus for ——. H. M. Sutton and W. L. and E. G. Steele, Dallas, Tex., U.S.A. Eng. Pat. 7225, March 21, 1914.

SEE U.S. Pat. 1,114,935 of 1914; this J., 1914, 1143.

Separation of particles from fluids; Centrifugal processes and apparatus for the ——. K. and A. Ward, Stockholm. Eng. Pat. 13,074, May 27, 1914.

SEE Fr. Pat. 472,701 of 1914; preceding.

Hydrating, pulping, or reducing material in a wet or semi-liquid state; Apparatus for ——. H. Jackson, Garstang. U.S. Pat. 1,133,968, March 30, 1915. Date of appl., May 14, 1912.

SEE Eng. Pat. 12,933 of 1911; this J., 1912, 636.

Crystals; Process and apparatus for obtaining large ——. Elektrochem. Werke G. m. b. H. Fr. Pat. 472,604, May 23, 1914. Under Int. Conv., July 16, 1913.

SEE Ger. Pat. 273,929 of 1913; this J., 1914, 822.

Centrifugal separators. H. Edenborough. Fr. Pat. 472,625, Aug. 27, 1913. Under Int. Conv., Sept. 26, 1912.

SEE Eng. Pat. 21,947 of 1912; this J., 1913, 954.

Kilns for the preparation of chlorosulphonic acid and for similar purposes. Fr. Pat. 472,612. *See* VII.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Chlorine in coal; [Corrosion due to] occurrence of ——. A. de Waele. Analyst, 1915, **40**, 146—150.

Rapid corrosion of the tubes of an economiser was found to be due to chlorine in the furnace gases, the tubes containing much ferric chloride. The coals used had been derived from the brine districts of the Midlands, and the whole of the chlorine (0·018 to 0·344% in six samples) was present as soluble chloride. In the case of another boiler-furnace in which nothing but Welsh coal had been used, there were no signs of pitting in the economiser tubes after three years. Eleven samples of the different coals used in this and neighbouring boilers contained 0·003 to 0·032% Cl. —C. A. M.

Cokes: Soluble chlorides and total chlorine in some English ——. S. W. Bridge. Analyst, 1915, **40**, 143—146.

Thirteen samples of gas-coke contained from 0·013 to 0·262% of soluble chlorides and 0·039 to 0·499% of total chlorine (both as NaCl). A sample of metallurgical coke contained 0·007% of soluble chlorides and 0·071 of total chlorine, and a low-temperature cannel residue, 0·357 and 0·918% respectively. The variations of the chlorine in coke are thus similar to those found in coal. The average amounts in Derbyshire cokes were higher than in the case of cokes from Durham, Lancashire, and Yorkshire. The low ratio of soluble to total chlorine in the metallurgical coke indicated the larger amount of chlorine expelled on carbonising the coal under coke-oven conditions. Samples of coal and cannel rich in chlorine were carbonised in a fireclay crucible at about 400° to 500° C., and also in a platinum crucible for 15 hours over a Méker burner. The proportion of total chlorine expelled at the higher temperatures was much greater than at lower temperatures. For example, a cannel containing 0·987% Cl left a low-temperature residue with 0·918% and a high-temperature residue with 0·314% Cl. *Determination of soluble chlorides:*—From 15 to 30 grms., crushed to pass a 10-mesh sieve, is boiled with water for an hour beneath a reflux condenser, the liquid filtered, and the filtrate and washings acidified with nitric acid, permanganate added till the liquid is pink, and the chlorine determined volumetrically. *Total chlorine:*—From 2·5 to 5 grms. is ignited with 3 to 6 grms. of a mixture of sodium carbonate and lime (1 : 2) until the carbon is completely oxidised, the mass boiled with water containing a little lead carbonate to remove sulphides, and the chlorine in the aqueous decoction determined as above. No material loss of chlorine occurs in burning off the carbon. C. A. M.

Coke-ovens: Application of by-product —— *to the gas industry.* J. D. Forrest. Indiana, U.S.A., Gas Assoc., March, 1915. J. Gas Lighting, 1915, **130**, 81—83.

The advantages of the by-product coke-oven are that the cost of labour per ton of coal carbonised is lower; the quantity, quality, and value of the coke produced are higher; the fuel requirements for carbonisation are more economical, and the quantity and quality of the gas and by-products are better than those obtained with gas retorts. On the other hand there is the difficulty of securing a market for the coke produced, and the initial outlay for installing the plant is heavy. In addition, great care is necessary in the selection of the coal. Failure to maintain proper heat conditions in the operation of a by-product cove-oven may mean not only loss in gas and by-products, but the production of a large amount of unsaleable coke. The author is of opinion that an ideal arrangement is one under which all the surplus gas from the coke-ovens is sold to a gas company. Where the consumption of gas was in excess of that supplied by the coke-ovens, the gas company would operate its own water-gas plant to make up the deficiency.—E. R. A.

Tar removal and recovery from carburetted water-gas. S. Carter. Manchester Junior Gas Assoc., April 10, 1915. J. Gas Lighting, 1915, **130**, 89—91.

Crude carburetted water-gas after ordinary condensation contains a considerable amount of light, persistent, greasy fog, which is eliminated in the first purifier, rendering the purifying material inactive. To remove tar fog, filtration under vacuum has been found to be more satisfactory than under pressure, as then the gas is not dried unduly. Fresh fog is developed, however, as soon as the gas passes the exhausters, and although of a light character, it is sufficient to render the purifying material inactive. It has been dealt with effectively by means of the "Hurricane" tar extractor or tar-trap (see Eng. Pat. 20,757 of 1911; this J., 1912, 913). This apparatus has an efficiency of about 90%, whatever the nature of the gas dealt with. In a specific case 80% of the tar fog remaining in the gas after simple condensation, was removed by the filters on the exhauster inlet, and 90% of the remainder in the "Hurricane," the total efficiency of the combination being 98%. 70° F. (21° C.) appears to be a critical temperature in the process of filtering carburetted water-gas at pressures about —5 inches; at this temperature difficulties have been experienced, which have not been encountered at lower or higher temperatures. The persistence of water in the recovered tar, forming an obstinate emulsion, has been dealt with successfully by adding "primary" or dry tar, whereby the light tarry constituents of the emulsion are dissolved and the water globules liberated. The emulsion is discharged into a 12-inch vertical pipe, open at both ends, standing in the settling tank containing "primary" or dry tar. One end of the tube is above the surface of the water and the other within 10 ins. of the bottom or below the level of the tar suction. The amount of "primary" tar produced is generally more than sufficient to treat all the "secondary" tar. The tar as sold contains about 1–2% of water. —E. R. A.

Benzol and its recovery from coal gas. F. Puning. Gas Record (Chicago), March 10, 1915. J. Gas Lighting, 1915, **130**, 84.

According to various tests of American coals, the average benzol recovery would amount to 2 gallons per net ton. From 1000 cb. ft. of gas produced from an average coal, about 0·18 gallon of benzol can be recovered, showing a profit of 1·7 cents (0·85d.), the loss in volume being inappreciable. If the benzol were recovered from all the coal carbonised in the by-product coke-ovens of the United States, the annual production would be 29,600,000 gallons, valued at $4,400,000 (nearly £920,000). The following calculation is given as an annual average based on 2000 net tons of dry coal per day.

Revenue

	Per cent.	Gallons.
Benzol	67	978,000
Toluol	16	234,000
Xylol	8	117,000
Solvent naphtha	9	131,000
		1,460,000

1,460,000 gallons at 15 cents	$219,000
Crude naphthalene, 330 net tons, at $5	1650
Regenerated acid, 40° B. (sp. gr. 1·383) 360 net tons at $6	2160
Total	$222,810

Expenditure.

Raw materials, as wash oil, sulphuric acid, caustic soda	$15,000
Steam for the different distillations	15,000
Electric power for water, oil pumps, agitator, and illumination	6200
Wages of 3 distillers and 2 helpers	5000
Overhead expenses, fire insurance, maintenance and depreciation, assuming the cost of the complete plant to be about $300,000	30,000
Calorific loss of the gases	13,000
Total	$84,200

Profit, $138,610 (about £28,877)=46% on the capital.
Cost to produce 1 gallon of benzol, 5·8 cents (2.9d.).

—E. R. A.

Gases; Firing of —— by adiabatic compression. III. Ignition-points of mixtures of electrolytic gas with argon. Ratio of the specific heats for nitrogen and hydrogen. IV. Ignition-points of mixtures of electrolytic gas with carbon dioxide. Ratio of the specific heats for carbon dioxide. J. M. Crofts. Chem. Soc. Trans., 1915, **107**, 290—313. (See also this J., 1914, 909.)

THE addition of argon or carbon dioxide to electrolytic gas produced a rise in the ignition point proportional to the amount of gas added, as previously observed with nitrogen and hydrogen. Combustion caused no appreciable reduction of the carbon dioxide to carbon monoxide. It is considered that added nitrogen or excess of hydrogen behaves like argon, as an inert gas, and similarly constituted mixtures, such as $2H_2+O_2+H_2$ and $2H_2+O_2+A$, are assumed therefore to have the same ignition temperature. Calculations based on this supposition led to a corrected value for the ignition temperature of electrolytic gas itself, *viz.*, 520° C. The ignition temperatures of $2H_2-O_2+xA$ were $(520+13x)°$ C. For temperature intervals 15°—t°, the mean values of molecular heats at constant volume, under the conditions of experiment, were calculated as: nitrogen, $4·7+0·0004t$; hydrogen, $4·86+0·00064t$; and carbon dioxide, $6·6+0·0023t$.—F. SODN.

Flame in mixtures of methane and air; Velocities of ——. II. A. Parker. Chem. Soc. Trans., 1915, **107**, 328—337. (See this J., 1914, 1000, and compare R. V. Wheeler, this J., 1914, 1195.)

THE initial velocities of propagation of flame in mixtures of methane and air were measured in tubes varying in internal diameter from 1 to 17·5 cm. The velocities increased considerably with the diameter of the tube, up to about 15 cm., and then approached a limiting value of about 108 cm. per sec., which would be obtained with a tube of somewhat more than 20 cm. diam. The limiting value is, however, only about 1% greater than that obtained with a tube of 15 cm. diam., which may be regarded as the minimum diameter yielding true values. The velocity varied with the nature of the igniting spark, and there was evidence that the electric spark induced a sharper initial inflammation than other modes of ignition, such as adiabatic compression.—F. SODN.

PATENTS.

Peat; Drying ——, and converting it into fuel. O. A. Ford and J. C. Long, Everett, Mass., U.S.A. Eng. Pat. 7593, March 25, 1914.

WET peat is fed into a long inclined rotating jacketed drum, provided with an internal helix, and hot gases from a boiler plant are passed through the drum in the reverse direction; the temperature is controlled by diverting a portion of the gas through the jacket, the regulating dampers being moved by a thermostat. The dried peat passes into a grinder. By-products may be recovered from the peat gases and from the furnace gases by passing them through a water-cooled condenser.—W. F. F.

Fuel; Composite briquette ——. E. Eaton, London. Eng. Pat. 11,345, May 8, 1914.

A MIXTURE of chalk 88% and solidified tar 12% is impregnated while in a mixing machine with 2—5% of petroleum or tar oils carried by a current of steam, and the mass is briquetted in the usual manner.—W. F. F.

Fuel; Artificial —— and method of making the same. E. J. Babcock, Grand Forks, N.D. U.S. Pat. 1,130,564, March 2, 1915. Date of appl., March 5, 1912.

NON-COKING low-grade coal or lignite is carbonised, and the residue is ground, mixed with from 4 to 10% (preferably 7%) of finely-divided coking coal, and 4 to 8% (6%) of pitch, heated to the melting point of the pitch; 0·5 to 2% (1·25%) of glutinous matter (dry flour from ground grain or seeds) is then added, and the mass briquetted.—W. H. C.

Coke-oven. A. Roberts, Evanston, Ill. U.S. Pat. 1,132,685, March 23, 1915. Date of appl., Sept. 8, 1914.

THE heating walls are built of blocks having recesses of varying depths formed in them, and so arranged that zig-zag passages of varying cross section are formed throughout the height and length of the walls.—W. F. F.

Vertical retorts; Regenerator settings for ——. S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 7757, March 27, 1914.

THE combustion, heating, waste-gas circulating, and secondary air-preheating chambers are divided by vertical partitions so that the gases pass over the opposite sides of the retorts in two parallel streams, moving in the same direction. Supplementary combustion chambers are also provided. —W. H. C.

Retorts used in the manufacture of gas and for like purposes; Apparatus for charging ——. Drakes, Ltd., and J. W. Drake, Halifax. Eng. Pat. 8091, March 31, 1914.

A ROTARY valve is mounted on a horizontal axis in a cylindrical casing fixed below the hopper, and having inlet and outlet openings, one or the other of which is closed by the valve. The valve is pressed against its seat by springs extending radially from the rotary shaft and adjustable in tension by screws. Openings are provided in the end walls of the casing for adjusting the screws. The movement of the valve is limited by stops. —W. F. F.

Gas furnaces; Heating —— with producer gas or lighting gas. R. Geipert. First Addition, dated April 11, 1914, to Fr. Pat. 471,644, March 20, 1914 (see this J., 1915, 414). Under Int. Conv., March 10, 1914.

WHEN lighting gas is used for heating the furnace, it is passed through the producer and is partly or wholly burnt therein; or it may be burnt before passing to the producer. During observation of the furnace temperature, when using lighting gas which has been only partly burnt, and hence gives a luminous flame, the lighting gas is either burnt completely in the producer during this period, or the supply is throttled.—W. F. F.

Water-gas; Continuous production of ——. Soc. Franç. d'Exploit. de Fours Spéciaux à Haute Température, and A. Verzier. Fr. Pat. 473,149, Sept. 8, 1913.

STEAM is generated from water contained in a pan which closes the bottom of the ashpit, and which is heated by the hot water-gas circulating through a collecting chamber to a space below the pan. Air for combustion is supplied through a superheating tube traversing the gas-collecting chamber and terminating at the side of the fuel bed.
—W. F. F.

Illuminating gases, and Mond and other gases for heating or power purposes; Purification of [from tar fog]. E. Howl, Dudley, and F. Perry, Tipton. Eng. Pat. 5051, Feb. 26, 1914.

THE gas is treated in a tower with a spray of water particles charged electrostatically. The suspended particles in the gas coalesce, and collect with the water in a tank at the bottom of the tower. Instead of a water spray, a stream of other electrified particles, *e.g.*, metal dust, may be used.—W. H. C.

[Coal] gas: Apparatus for recovering sulphur and ammonia from —— [by washing]. E. F. Lloyd, Detroit, Mich. U.S. Pat. 1,132,594, March 23, 1915. Date of appl., April 21, 1913.

THE washing liquor passes through a wash cooler to a scrubber, to which fresh water is also supplied, the mixed ammoniacal liquor passing thence to a still supplied with a current of steam. The liquor is tapped from the still at a point where it is free from sulphur, and returned to the scrubber. The cooling medium from the wash cooler is used to reduce the temperature of the tapped liquor and also that discharged from the still.—W. F. F.

Fuel for internal combustion engines. R. Wood, Durban, Natal. Eng. Pat. 24,262, Dec. 18, 1914.

A MIXTURE of alcohol (67° O.P.) 54·3, ether 45·0, ammonia (NH_3) 0·5, and white arsenic 0·2 parts by weight.—W. F. F.

Gasoline; Manufacture of ——. R. F. Bacon, B. T. Brooks, and C. W. Clark, Assignors to Gulf Refining Co., Pittsburgh, Pa. U.S. Pat. 1,131,309, March 9, 1915. Date of appl., May 2, 1913.

PETROLEUM oils, which have a boiling point of 250° C. and upwards, are converted into a mixture of hydrocarbons, boiling below 200° C., by submitting them to a combined distilling and cracking operation in a vertical tubular retort at a temperature of 350°–500° C. and a pressure of 60–300 lb. per square inch. The particles of tar and coke produced sink to the bottom of the retort, and are removed.—W. H. C.

Lubricant. A. Warrell, Assignor to Continental Asbestos Corporation, Worcester, Mass. U.S. Pat. 1,133,204, March 23, 1915. Date of appl., June 6, 1914.

A PERMANENT putty-like magma formed by the prolonged agitation of chrysotile asbestos or asbestos tailings in hot lubricating oil. W. F. F.

Liquid fuel suitable for combustion and lighting (internal combustion engines and motor vehicles); Manufacture of —— from coal tar. M. Lorand. Fr. Pat. 472,860, June 2, 1914.

COAL tar is agitated for some hours with a 1% soda solution which is then decanted, and the tar is distilled, the light oil (b. pt. about 200°–280° C.) which distils after the water and the first oily portions being collected. The residue may be used in the manufacture of asphalt. W. F. F.

Agglomerated combustibles: Manufacture of ——. L. Martel, Gard, France. Eng. Pat. 7664, March 26, 1914. Under Int. Conv., March 27, 1913.

SEE Fr. Pat. 456,061 of 1913; this J., 1913, 936.

Gas retorts; Vertical ——. A. G. Glasgow, Richmond, Va., U.S.A. From J. H. Taussig, Philadelphia, U.S.A. Eng. Pat. 8829, April 7, 1914.

SEE Fr. Pat. 471,142 of 1914; this J., 1915, 166.

Gas: Means for withdrawing —— from retorts. D. D. Barnum, Worcester, Mass., H. A. Carpenter, Sewickley, Pa., and Riter-Conley Manufacturing Co., Pittsburg, Pa., U.S.A. Eng. Pat. 5142, Feb. 27, 1914.

SEE U.S. Pat. 1,091,111 of 1914; this J., 1914, 471.

Gas: Apparatus for producing ——. W. R. Degenhardt, Kalgoorlie, and W. Jordan, Youanme, W. Australia. U.S. Pat. 1,133,010, March 23, 1915. Date of appl., Nov. 14, 1913.

SEE Fr. Pat. 464,265 of 1913; this J., 1914, 472.

Gas-producer grates: Ash-discharging device for ——. Q. Moore, Glasgow. U.S. Pat. 1,133,995, March 30, 1915. Date of appl., Jan. 26, 1915.

SEE Eng. Pat. 2619 of 1914; this J., 1915, 414.

Gas producers. The Power Gas Corporation, Ltd. Fr. Pat. 473,331, May 18, 1914. Under Int. Conv., Feb. 20, 1914.

SEE Eng. Pat. 4452 of 1914; this J., 1914, 636.

Gas; Purification of ——. H. F. Smith, Lexington, Ohio, U.S.A. Eng. Pat. 11,246, May 6, 1914.

SEE Fr. Pat. 472,306 of 1914; this J., 1915, 414.

Hydrocarbons; New product [liquefied gas] with a basis of ——. F. P. Peterson. Fr. Pat. 472,848, May 30, 1914. Under Int. Conv., Jan. 5, 1914.

SEE U.S. Pat. 1,094,864 of 1914; this J., 1914, 585.

Motor spirit from peat tar; Manufacture of ——. T. Franke. Fr. Pat. 473,035, June 4, 1914. Under Int. Conv., June 7 and July 4, 1913.

SEE Eng. Pats. 13,261 and 15,459 of 1913; this J., 1914, 782.

[Hydrocarbon] oils; Decomposition of —— by heat, especially for the production of liquid fuels. C. E. C. Luck. Fr. Pat. 473,334, May 22, 1914. Under Int. Conv., May 23, 1913.

SEE Eng. Pat. 12,059 of 1913; this J., 1914, 685.

Precipitation tank [for oil]. U.S. Pat. 1,129,893. *See* XII.

Application of naphthenic acids, their soaps, and solutions as insecticides, and process of making the solutions. Fr. Pat. 472,561. *See* XIXB.

Viscosimeter. U.S. Pat. 1,132,621. *See* XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Nitrogen containing a small proportion of methane or carbon monoxide: Behaviour of half-watt lamps filled with ——. L. Hamburger. Chem. Weekblad, 1915, **12**, 62–73. J. Chem. Soc. 1915, **108**, ii., 81–82.

THE presence of more than 0·05% CH_4 or 2% CO in the nitrogen employed rendered the filament brittle and shortened the life of the lamp.
—F. SODN.

Chemical reactions at very low pressures. Langmuir. *See* VII.

PATENTS.

Heat; Generating —— by interaction between metals and metallic compounds. A. Lang and J. Schmitt. Fr. Pat. 473,095, June 5, 1914.

FINELY-DIVIDED metals having different heats of combination are mixed in equivalent proportions with metallic oxides or sulphides, and the mixture is compressed or mixed with a suitable binder and then granulated. A mixture of aluminium, iron, zinc, barium peroxide, and manganese dioxide is given as an example. The mixtures may be used as explosives.—W. F. F.

Incandescent gas mantles. I. More, Ashburton, New Zealand. Eng. Pat. 14,973, June 23, 1914. Under Int. Conv., March 13, 1914.

A MIXTURE of 100 parts by weight of refined white china clay and one of potassium permanganate with 7500 to 8000 of water, is applied to the finished unvarnished mantle.—B. N.

Rare earths for incandescence lighting by means of gas blowpipes; Composition of ——. Soc. L'Oxylithe. Fr. Pat. 473,222, Sept. 13, 1913.

A MIXTURE of thorium oxide, 92%, cerium oxide, 2%, magnesia, 2%, lime, 1%, and a flux of an alkali polysilicate (powdered glass), 3%, is placed in a hollow muff of corundum, alundum, or other refractory material, provided with a circular groove on the inside to retain the mixture. The surface of the mixture, acted upon by the blowpipe flame, is hardened by the flux, and may be regenerated by applying a small quantity of the dry or slightly wetted composition.—B. N.

Photometers. Eng. Pat. 776. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Unsaturated organic compounds: Addition products of —— with nitric acid and picric acid. G. Reddelien. J. prakt. Chem., 1915, **91**, 213—244.

NITRIC acid yields addition products with substances containing the groups C : O, C : N, or N : N. Nitrates of the following compounds are described: benzaldehyde, colourless oil: cinnamic aldehyde, white crystalline mass, m. pt. 60°—61° C.; acetophenone, colourless oil; benzophenone, yellowish prisms, m.pt. 30°—31° C.; fluorenone, orange-red needles, m. pt. 63°—64° C.; benzil, yellow needles: phenanthrenequinone, red needles, m. pt. 80°—83° C.: camphor, white crystals, m. pt. 10°—11° C.; benzophenoneanilide, light-yellow crystals, m. pt. 166°—167° C.; fluorenoneanilide, orange crystals, m. pt. 136°—137° C.; azobenzene, orange-red crystals. In each case one molecule of the substance combines with one molecule of nitric acid. Picric acid yields similar products with substances containing any one of the groups C : O, C : N, N : N, or C : C, but the last type of compound does not give addition products with nitric acid. Picrates of the following substances are described: benzaldehyde, light-yellow prisms, m. pt. 70°—72° C.; cinnamic aldehyde, light-yellow needles, m. pt. 66°—67° C.; acetophenone, yellow prisms, m. pt. 53° C.; dibenzalacetone, orange crystals, m. pt. 113°—114° C.: benzophenoneanilide, yellow crystals, m. pt. 188°—189° C.; fluorenoneanilide, red prisms, m. pt. 187°—188° C.; azobenzene, red crystals. The composition of the picrates is similar to that of the nitrates. All the derivatives are readily hydrolysed, so that in preparing the nitrates the strength of the acid has to be carefully regulated. The derivatives are also decomposed by solvents in which one component is easily and the other sparingly soluble. Addition compounds are formed with increasing ease and possess increasing stability in the series, C : C, N : N, C : O, C : N. Benzaldehyde nitrate separates as an upper layer after shaking 2 grms. of the aldehyde at 0° C. with 10 c.c. of nitric acid of sp. gr. 1·371; the picrate crystallises when a melt of 6 grms. of the aldehyde and 4 grms. of the acid is allowed to cool. The constitution of these substances and the related question of the constitution of benzene are fully discussed.—J. R.

Aniline; Bromination of ——. H. Franzen and A. Henglein. J. prakt. Chem., 1915, **91**, 245—257.

Benzylideneaniline dibromide is obtained in 83% yield by slowly adding bromine (80 grms.) in chloroform (50 c.c.) to an ice-cooled solution of benzylideneaniline (90 grms.) in the same solvent (150 c.c.) and allowing to stand for an hour. The temperature must not rise above 25° C. *Benzylidene-p-bromoaniline hydrobromide*, $Br.C_6H_4.NH.CHBr.C_6H_5$, is prepared by slowly adding absolute alcohol (200 c.c.) to the thick yellow paste obtained in the foregoing operation. After standing for two hours the mixture is cooled in ice; the deposited pale yellow crystalline powder (52 grms.) is collected, washed with a little chloroform, and dried. *Benzylidene-p-bromoaniline*: a mixture of benzylideneaniline dibromide (170 grms.) and absolute alcohol (100 c.c.) is shaken with pyridine (50 grms.) and complete solution effected by heating on the water-bath. Upon pouring into an ice-cooled porcelain dish the mixture solidifies to an almost colourless mass; it is ground up with a little absolute alcohol, drained with the aid of the pump, washed sparingly with ice-cold alcohol, and dried. Yield, 90%; m. pt., after recrystallisation from methyl alcohol, 67° C. *p-Bromoaniline*: benzylideneaniline dibromide (170 grms.) is dissolved in absolute alcohol (200 c.c.) by warming, diluted (1 : 1) hydrochloric acid (500 c.c.) is added, and benzaldehyde completely removed by steaming. The residue when poured into several litres of dilute ammonia and allowed to stand for 24 hours yields a colourless crystalline mass of p-bromoaniline, which is freed from oil by pressure and crystallised from alcohol or petroleum ether. Yield, 65%; m. pt. 63° C. *Benzylidene-p-bromoaniline dibromide*, $Br.C_6H_4.NBr.CHBr.C_6H_5$: a solution of bromine (32 grms.) in chloroform (20 c.c.) is added slowly to an ice-cooled solution of benzylidene-p-bromoaniline (52 grms.) in chloroform (120 c.c.), the temperature being kept below 25° C. After two hours the thick paste is drained with the aid of the pump, washed with chloroform, and dried. Yield, 84%; m. pt., 182° C. *Benzylidene-2.4-dibromoaniline hydrobromide* $Br_2 : C_6H_3.NH.CHBr.C_6H_5$: absolute alcohol (100 c.c.) is added to benzylidene-p-bromoaniline dibromide (70 grms.) and solution completed by warming on the waterbath. The yellow crystalline powder, which separates on cooling, is collected and washed with a little ice-cold absolute alcohol. A second fraction is obtained by adding dry ether (250 c.c.) to the mother-liquor. Yield, 30 grms. *2.4-Dibromoaniline*: benzylideneaniline (184 grms.) is brominated as above and pyridine (80 grms.) added slowly to the chloroform suspension of the product. Bromine (160 grms.) in chloroform (100 c.c.) is added slowly to the ice-cooled mixture; absolute alcohol (400 c.c.) is stirred into the resulting paste; the mixture is poured into 1·5 litres of sulphuric acid (1 : 10), and the whole is distilled with steam till benzaldehyde is completely expelled and colourless crystals appear in the condensing tube. The hot acid is decanted from the residual solid cake which forms after partial cooling, and the powdered solid is then boiled with dilute sulphuric acid (1·5 litres). The extract deposits colourless leaflets of 2.4-dibromoaniline sulphate upon cooling: the base is liberated with ammonia

and crystallised from alcohol. Yield, 48%; m. pt., 80° C. The portion undissolved by the sulphuric acid consists of 2.4.6-*tribromoaniline* and is purified by crystallisation from alcohol. *Benzylidene-2.4-dibromoaniline*, $Br_2:C_6H_3.N:CH.C_6H_5$: 2.4-dibromoaniline (90 grms.) is heated with absolute alcohol (100 c.c.) and benzaldehyde (40 grms.) for an hour upon the waterbath, after which the alcohol is distilled. The residual oil crystallises upon inoculation. The substance crystallises from alcohol, with which it readily forms supersaturated solutions, in pale yellow needles melting at 67° C. Yield, 83%. *Benzylidene-2.4-dibromoaniline dibromide*, $Br_2:C_6H_3.NBr.CHBr.C_6H_5$: the preceding substance (60 grms.) when dissolved in ice-cooled chloroform (100 c.c.) and treated with bromine (28 grms.) in chloroform (20 c.c.) yields orange-yellow needles melting at 115°—120° C. Yield, 68%. 2.4.6-*Tribromoaniline*: the preceding substance (27 grms.) upon warming on the waterbath with absolute alcohol (20 c.c.) yields a crystalline mass of 2.4.6-tribromoaniline hydrobromide, which when crystallised from alcohol gives 2.4.6-tribromoaniline, melting at 120° C.; if pyridine (6 grms.) is added to the original mixture the pure free base crystallises out directly.—J. R.

Orthoformic ester; Use of —— as an alkylating agent. R. von Walther. J. prakt. Chem., 1915, **91**, 258—260.

ORTHOFORMIC ester is hydrolysed by aqueous picric acid, but when a mixture of equal weights of the two substances is heated slowly to 170° C. in an oil-bath, 2.4.6-trinitrophenetol is produced in good yield, thus:

$$HC(OC_2H_5)_3 + C_6H_2(NO_2)_3OH = C_6H_2(NO_2)_3O.C_2H_5 + C_2H_5OH + H.COOC_2H_5.$$

A similar reaction occurs to a lesser extent when 2.4-dinitrophenol is heated over a naked flame with an equal weight of orthoformic ester.—J. R.

Homopiperonyl and homoveratryl alcohols; Reaction of ——. G. M. Robinson. Chem. Soc. Trans., 1915, **107**, 267—276.

HOMOPIPERONYL alcohol and homoveratryl alcohol undergo condensation to anthracene derivatives under the influence of mineral acids. The condensed homoveratryl alcohol is 2.3.6.7-tetramethoxy-9.10-dihydroanthracene, m. pt. 227° C. On nitration this yields 6.6′-dinitro-3.4.3′.4′-tetramethoxydiphenylmethane, m. pt. 138° C., the constitution of which was proved by its synthesis from tetramethoxybenzophenone. The reactivity of homopiperonyl alcohol suggests that the polymerisation of *iso*-safrole is due to a similar underlying condensation. The formula:

$$CH_2O_2:C_6H_2{<}{\substack{CH(C_2H_5)\\CH(C_2H_5)}}{>}C_6H_2:O_2CH_2,$$

derived in this way for di-isosafrole explains its *cis-trans* isomerism.—G. F. M.

Coumarin derivatives; Formation of —— and preparation of stable coumarinic acids. L. A. Jordan and J. F. Thorpe. Chem. Soc. Trans., 1915, **107**, 387—406.

COLD alcoholic sodium ethoxide converts ethyl isodehydracetate into a mixture of the labile modification of ethyl β-methylglutaconate (Chem. Soc. Trans., 1912, **101**, 1557) and a neutral substance, m. pt. 135° C., which is now shown to be ethyl 3-acetyl 4.5.7-trimethylcoumarin-6-8-dicarboxylate. This substance dissolves in alkali hydroxides, and on acidifying, the corresponding coumarinic acid is precipitated. Other coumarin derivatives were prepared by hydrolysing in stages the acetyl and the two carbo-ethoxy groups, complete hydrolysis yielding 4.5.7-trimethylcoumarin. The 3-acetyl group and the 6-carbo-ethoxy group are very stable to alkalis but can be hydrolysed by sulphuric acid, the corresponding coumarinic acids being formed. These are relatively stable, the most stable being that containing a carboxy group in position 8. Phosphorus pentachloride and phosphoryl chloride produce an intense purple coloration destroyed by alcohol, with all coumarins substituted in position 4. The substances to which the colour is due can be isolated as dark blue powders with a coppery reflex. They contain phosphorus and are rapidly acted on by moist air. Water converts them into the coumarin or coumarinic acid. All the coumarins described, aborb ed bromine to give a 3-bromocoumarin. Some nitrocoumarins were also prepared: the 6-position is readily substituted by the nitro group, whilst the 3-position is only substituted with difficulty. All the 4-substituted coumarins dissolve in alkali, yielding colourless solutions of the salt of the corresponding coumarinic acid. It is suggested that the yellow salts of coumarinic acids are *o*-quinone derivatives, whilst the colourless salts of 4-substituted coumarinic acids have the normal coumarinic acid structure.—T. C.

Tar removal and recovery from carburetted water-gas [*and toluene recovery from gas*]. Carter. *See* IIA.

Benzol and its recovery from coal gas. Puning. *See* IIA.

PATENTS.

Benzol from heavy oils: Apparatus for the direct extraction of —— [in one distillation]. E. Barbet et Fils et Cie. Fr. Pat. 473,082, Sept. 5, 1913.

HEAVY oils, containing 2% of benzol, are separated into various fractions in two successive operations carried out in a column distilling apparatus. The oil is first distilled by heating coils supplied with high-pressure steam, and the naphthalene then separated by the injection of low-pressure superheated steam.—F. W. A.

Benzol, especially heavy benzol; Process for deodorising —— and rendering it non-explosive and non-inflammable. I. I. Lipszyc. Fr. Pat. 473,309, Sept. 15, 1913.

BENZOL is deodorised by treatment with an oxidising agent, such as potassium or calcium permanganate in neutral or sulphuric acid solution, and subsequently washing with water and caustic soda. It is rendered non-explosive and non-inflammable by mixing it with 10 to 25% of trichloro-ethylene or with other chloro-hydrocarbons.—F. W. A.

Diarylated chloro-ureïdes; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 472,941, May 13, 1914. Under Int. Conv., Aug. 1, 1913.

SEE Eng. Pat. 20,107 of 1913; this J., 1914, 825.

[*Extraction*] *apparatus for the separation of mixtures of liquids into two components.* Fr. Pat. 472,560. *See* I.

Manufacture of a liquid fuel suitable for combustion and lighting (internal combustion engines and motor vehicles) from coal tar. Fr. Pat. 472,860. *See* IIA.

IV. COLOURING MATTERS AND DYES.

Indigo: Natural v. synthetic ——. J. P. Srivastava and W. Cole. J. Soc. Dyers and Col., 1915, **31**, 100—102.

BERGTHEIL and Briggs (see this J., 1907, 314; J. Soc. Dyers and Col., 1907, 146) stated that

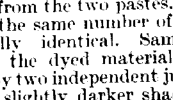
natural indigo dyes a deeper and fuller shade than synthetic indigo. The Badische Company explained this result by stating that the brand of the synthetic product used was unsuitable for dyeing wool in a hydrosulphite vat. Pastes of a fine Bengal indigo and a synthetic indigo were analysed by the authors, by Bergtheil, and by the Badische Company, and for each paste a number of indigotin units was agreed upon to represent the relative strengths. On dyeing wool to a standard shade in vats prepared from the two pastes, the amounts of wool dyed by the same number of indigotin units were practically identical. Samples of cloth obtained from the dyed materials could not be distinguished by two independent judges. Natural indigo dyed a slightly darker shade, whereas the dyeings obtained from synthetic indigo were of a more "bloomy" shade; both these advantages were destroyed on scouring and milling. The amount of reducing agent required was appreciably less in the case of the synthetic product, the uniformity of which is also an advantage.—F. W. A.

Indigo: Exportation of natural ——. Board of Trade Announcement, April 30, 1915.

THE reservation of the stock of natural indigo primarily for dye users in the United Kingdom (see this J., 1915, 348), will be maintained only until Saturday, May 8th, 1915. After that date the Government Brokers, Messrs. Lewis and Peat, 6, Mincing Lane, London, E.C., will accordingly be prepared to entertain applications from buyers desirous of exporting natural indigo from this country.

Benzopyranol derivatives. J. N. Collie and G. N. White. Chem. Soc. Trans., 1915, **107**, 369—376.

UNDER the influence of concentrated mineral acids orcinol condenses with acetylacetone to give a mixture of the salts of two benzopyranols, which can be separated by fractional crystallisation from aqueous hydrochloric or hydrobromic acids. The 7-hydroxy-2.5-dimethyl-4-methylene-γ-benzopyranol.



is an orange substance, giving a lemon yellow hydrochloride, a platinum double chloride, and a greenish yellow hydrobromide; it dissolves in sodium hydroxide to give a feebly yellow solution. 5-Hydroxy-2.7-dimethyl-4-methylene-γ-benzopyranol, is a violet substance, giving an orange hydrochloride; it dissolves in sodium hydroxide to an almost colourless solution. Both substances can be acetylated, but do not yield condensation products with hydroxylamine, semicarbazide, etc., nor are they readily reduced. These facts are in agreement with the above constitution rather than the alternative quinonoid form. Prolonged boiling with concentrated hydrochloric acid and tin converts them into dihydro-compounds. Both these and the acetyl-compounds are colourless, and are remarkable in not forming salts with acids. It is suggested that the bases and their salts are quinonoid; the acetyl derivative, on the other hand, is benzenoid and therefore colourless. These benzopyranols are related to the natural dyes, apigenin and luteolin, and also to the anthocyanin colours found in flowers.—G. F. M.

PATENTS.

Chrome-mordant dyestuffs; Manufacture of ——. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat., 472,737, May 27, 1914. Under Int. Conv., Nov. 5, 1913, and May 6, 1914.

YELLOW chrome mordant dyestuffs are obtained by combining diazotised anthranilic acid, or a substitution product, with pyrazolonesulphonic acids or their derivatives. The dyestuffs may be dyed direct in presence of bichromate, or the wool treated with bichromate before dyeing; in the latter case it is necessary to chrome the dyeings subsequently with bichromate to render them fast to milling. When dyed on wool in the usual way and after-treated with bichromate, the shades produced are fast to alkalis and to milling, and remarkably fast to carbonising, stoving, and to light.—F. W. A.

Azo dyestuffs; Manufacture of insoluble ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 472,889, June 2, 1914. Under Int. Conv., Dec. 4, 1913.

AZO dyestuffs, which are insoluble in water and possess remarkable properties of fastness, are obtained by combining diazo- or tetrazo-compounds of the aromatic series, which do not contain a sulphonic or carboxylic group, with 2-acylamino-3-naphthols. The dyestuffs obtained are faster to chlorine than those from 1-acylamino-4-naphthols (Witt, this J., 1896, 134). They may be used in the manufacture of lakes, or produced on the fibre as usual for ice colours.—F. W. A.

Azo dyestuffs and products used in producing them. Badische Anilin und Soda Fabrik. Fr. Pat. 472,893, June 2, 1914. Under Int. Conv., Feb. 6 and April 3, 1914.

DIAZO-, diazotised azo-, or tetrazo-compounds which do not contain a sulphonic group are combined with derivatives of 1.7-aminonaphthol of the general formula (7)$HO.C_{10}H_6.NHR$(1), in which R is derived from an aromatic acid or from an arylsulphonic acid. The dyestuffs obtained are insoluble in water, and are best produced on the fibre. The dyeings are characterised by brightness in shade and fastness to washing, to chlorine, and to light. In presence of a suitable substratum, pigments are obtained. The derivatives of 1.7-aminonaphthol required are obtained by the method of Sachs (this J., 1906, 1036), or by treating 1.7-aminonaphthol in solution or suspension in an indifferent medium with the equivalent amount of the acid chloride, in presence or in absence of neutralising agents. Benzoyl-, *o*-chlorobenzoyl-, *p*-chlorobenzoyl-, 2.4-dichlorobenzoyl-, 2.6-dichlorobenzoyl-, *m*-nitrobenzoyl-, *p*-toluenesulphonyl-, and *p*-chlorobenzenesulphonyl-1.7-aminonaphthol are especially claimed.—F. W. A.

Sulphur colours. J. Flachslaender, K. P. Gralert, and M. Buff, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,132,922, March 23, 1915. Date of appl., Sept. 16, 1913.

SEE Fr. Pat. 449,983 of 1912; this J., 1913, 180.

Indigoid dyes; Treating insoluble ——. R. Hutzler, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,031, March 23, 1915. Date of appl., Sept. 26, 1913.

SEE Ger. Pat. 265,536 of 1912; this J., 1913, 1101.

Colouring matters of the anthraquinone series; Production of ——. H. Wolff, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,081, March 23, 1915. Date of appl., Sept. 26, 1913.

SEE Fr. Pat. 459,105 of 1913; this J., 1913, 1101.

Vat dyestuffs; Production of red ——. Badische Anilin und Soda Fabrik. Seventh Addition, dated May 4, 1914, to Fr. Pat. 365,920, May 4, 1906. Under Int. Conv., July 31, 1913.

SEE Eng. Pat. 21,133 of 1913; this J., 1914, 855.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton: Microscopical studies on ——. A. Herzog. Chem.-Zeit., 1914, **38**, 1089—1091, 1097—1100.

In the trade, the abnormal thin-walled fibres known as "dead" and "unripe" are not particularly differentiated; in woven goods they roll up into small knots which appear as light-coloured spots in dyed fabrics. These two types are, however, not identical either in character or origin. Dead fibres are most frequent in degenerated plants and those which have run wild, but are also met with to some extent in good sorts. They appear under the microscope as broad tubular ribbons, without cell-contents, the upper and lower walls being in close contact except where longitudinal folds are caused by a slight sliding movement. The thickness of the walls is only 0·5—0·6 μ and the breadth of the flattened ribbon exceeds that of the normal fibre by 31—65%. The walls of many of the fibres show striations at an angle of 45° to the axis. The cuticular layer is very slightly developed and does not produce the usual globular swellings under the action of cuprammonium. Comparative dyeings with Methylene Blue showed no appreciable difference in intensity between the dead and the normal fibres; the apparent resistance of the former is therefore probably an optical effect due to the extreme thinness of the fibre-wall. The dead fibres are doubly refractive, showing colours under the polarising microscope; the insertion of a mica plate of 1·8 λ affords a ready means for their differentiation among the normal fibres. The latter remain bright in all positions, while the broad, flat, dead fibres show black and white portions according to their relative position in the field. In the case of unripe fibres the thickness of wall is at least 1μ; the cuticle is only weakly developed, and the action of cuprammonium is similar to that with the dead fibres. The interior of the fibre is, however, very rich in protoplasmic residues; no differentiation of the cellulose walls can be detected, and striations are absent. The protein contents cause the fibre to absorb substantive dyestuffs more intensely than the normal fibre, but the cellulose absorbs but little. Basic dyestuffs on mordants, however, give only pale shades owing to the thinness of the walls. The fibre is of about normal breadth, but it is not twisted. Under the polarising microscope with mica plate, the contrasts of light and dark portions are less marked than in the case of the dead fibres.

"Beard" fibres, short, coarse, very stiff and distinctly coloured fibres, occur at the pointed end of the cotton seed and are collected along with the down in the treatment of the hull-residues. Their dimensions vary within wide limits; average values recorded are: breadth, 45·1μ; length, 2·4 mm. The author recognises three types. Type 1, the most common, is very irregular in breadth and structure; the walls are fairly thick but less so than those of the textile fibre. The interior and even the walls are highly charged with coloured protein matters, beard fibres from Egyptian seeds showing 1·86—2·46% N, against 0·49—0·51% for the textile fibres; the lumen is often filled with protoplasm. The cuticle is not strongly developed but the fibres are charged with an excess of fatty matters in a similar degree to the protein. They swell rather slowly in cuprammonium and the cell wall is thereby stratified into a large number of well differentiated layers, while the protoplasm remains insoluble. Type 2 is exceptional, very rarely met with; the fibres are flat, ribbon-like, very broad, often folded or twisted. They are gradually dissolved by cuprammonium, without stratification. The protoplasmic contents are deep brown in colour and present in very large quantities (*e.g.*, 23·1% of protein), especially near the base. Type 3 occurs particularly in wild or degenerated plants; the fibres are similar in breadth to the textile fibres, with spiral structural markings at an angle of 50°—63°. They are poor in protein, only slightly coloured, with cuticle only slightly developed; they dissolve in cuprammonium without special characteristics. The interior of the fibres is often penetrated by fungus mycelium, which is stained by aniline blue-glycerin.

Testing the mercerising capacity of cotton yarns. Lack of lustre on mercerisation may generally be traced to the presence of incompletely ripened or otherwise abnormal fibres. In order to test the mercerising capacity, sections of the raw yarn about 0·5 mm. long (*e.g.*, 10 separate sections) are mounted in a mixture of potassium hydroxide and glycerin on slides ruled with fine lines to facilitate counting. In each mount 100 fragments are counted without selection, those which fail to show a perfectly cylindrical form being reckoned as non-mercerised. The proportion of cylindrical fragments is in direct relation to the lustre obtainable, *e.g.*, very high lustre, 93—98%; satisfactory, 83—87%; inferior, 68—75%.—J. F. B.

Parchment paper: Tests for distinguishing —— from pergamyn paper. G. Annoni and G. Rodano. Ann. Lab. Chim. delle Gabelle, 1914, **7**, 19. L'Ind. Chim., 1915, **2**, 129.

Parchment paper, prepared by the action of sulphuric acid on rag paper, is resistant to boiling water and to a boiling 2% solution of potassium carbonate, whereas the imitation pergamyn papers, prepared by mechanical treatment of wood pulp, are much less resistant to water and are immediately disintegrated by a boiling 2% solution of potassium carbonate. On treatment with a drop of zinc chloride-iodine solution, a violet stain is produced on both kinds of paper, though more slowly on the pergamyn, but on subsequent treatment with water, the violet changes to an intense blue—due to hydrocellulose—in the case of parchment paper, whilst only a faint violet coloration is left on pergamyn paper. Pergamyn papers invariably contain resin, whilst this is absent from parchment papers; hence the production of a reddish violet coloration on applying Morawski's reaction—treatment with acetic anhydride and sulphuric acid in succession—is a proof that the sample is a pergamyn paper.—A. S.

Sulphite-cellulose manufacture: Utilisation of volatile waste products of ——. H. Bergström. Papierfabr., 1914, **12**, 1010—1012. Z. angew. Chem., 1915, **28**, Ref., 47.

If the vapours "blown off" from sulphite pulp boilers be condensed, sulphurous acid, methyl alcohol, cymene, and small quantities of furfural and of a solid terpene alcohol can be recovered from the condensed liquid, which contains 100 grms. of sulphurous acid and 5—5·5 grms. of methyl alcohol per litre, and 1—1·5 kilos. of oil, furfural, etc., per ton of cellulose. Moreover the quality of the cellulose would be improved by removing these products from the condensed liquid before using it again in the boiling process. Considerable quantities of methyl alcohol, and possibly also some acetic acid, could be recovered by evaporating the spent lyes from the boilers. (See also this J., 1912, 381, 711; 1913, 358.)—A. S.

Cellulose manufacture: Terpene substances as by-products of ——. A. Hellström. Papierfabr., 1914, **12**, 1025. Z. angew. Chem., 1915, **28**, Ref., 47. (See also this J., 1914, 745.)

The turpentine oil and methyl alcohol can be freed from methyl sulphide by fractionation in a column still. Oils which have been freed from

resinified constituents by distillation can be easily refined by treatment with sulphuric acid. The liquid resin obtained as a by-product in the manufacture of soda-cellulose is used for sizing paper and for the manufacture of rosin oil and lubricating greases. The oil may be hardened by hydrogenation, and the pitch obtained from it may be used for insulating electric cables.—A. S.

PATENTS.

Fabrics; Machines for drying ——. W. Mycock. Salford. Eng. Pat. 7054, March 20, 1914.

IN machines consisting of stacks of steam-heated drying cylinders, the framework is constructed entirely or almost entirely of the "doll-heads" in which the trunnions of the cylinders are mounted. The doll-heads are bolted together by means of flanges, forming a columnar frame, each column being attached to the steam-main at the bottom and supported at the top by screwed rods depending from a fixed girder.—J. F. B.

Cellulose: Process for obtaining lustrous threads of a basis of ——. P. Joliot. First Addition, dated Aug. 4, 1913, to Fr. Pat. 468,380, April 22, 1913 (this J., 1914, 958).

IT is sufficient to apply tension to the threads either before or during the reconversion to cellulose, *i.e.*, after the treatment with alkali and carbon bisulphide described in the principal patent. The process may be applied to cellulose fabrics, and the elasticity of the final product may be varied by altering the degree of tension applied before the reconversion to cellulose.—F. SP.

Cellulose esters; Manufacture of ——. Soc. Chim. des Usines du Rhône. Fr. Pat. 473,399, June 12, 1914. Under Int. Conv., June 25, 1913.

THE esterification of cellulose is preceded by a preliminary treatment in presence of small quantities of acetic anhydride. *Example*: 10 parts of cellulose is kept for several hours at 30° C. in a mixture of 60 parts of glacial acetic acid, 4 parts of acetic anhydride, and 0·5 part of 100% sulphuric acid, and 21 parts of acetic anhydride is then added, whereupon the cellulose is rapidly acetylated and dissolved. Precipitation with water yields a product soluble in chloroform, very slightly soluble in alcohol, and insoluble in nitrobenzene, acetone, or ether. Partial saponification produces esters, some of which are soluble in acetone.—F. SP.

Celluloid substitute from gelatin and casein: Preparation of a ——. F. von Kageneck. Ger. Pat. 281,541, Nov. 12, 1913.

A MIXTURE of gelatin and casein is treated with sodium silicate solution and then with a hardening agent such as alum.—A. S.

Paper pulp; Apparatus for use in the squeezing and washing of ——. S. Milne, Edinburgh. Eng. Pat. 6948, Mar. 19, 1914.

THE apparatus comprises two horizontal endless wire cloths, the lower wire passing round a perforated drum and the upper wire round a roller which presses against the perforated drum. The pulp is fed into a hopper in close contact with the lower wire on the perforated drum and, after squeezing, passes on as a layer between the two wires. Press rolls or vacuum boxes are arranged at intervals along the path of the wires, and troughs are placed beneath each set of press rolls or vacuum boxes. Fresh water is added to the pulp in front of the last set of press rolls, and the washings collected in the trough are delivered in front of the preceding set of rolls, and so on in the reverse direction to the travel of the pulp, and are drawn off in a concentrated form at the first set of rolls.—J. F. B.

Wood pulp, especially brown pulp; Manufacture of ——. A. Zacharias. Ger. Pat. 280,476, Jan. 10, 1914.

THE wood, without removing the bark, is subjected to a boiling and steaming process, with addition of caustic soda lye, and afterwards is barked and cleaned by means of brushes.—A. S.

Sulphite-cellulose waste lyes; Process for utilising the fermentable and reducing carbohydrates in —for obtaining alcohol or a reducing agent. H. B. Landmark. First Addition, dated May 20, 1914, to Fr. Pat. 456,871, April 19, 1913 (this J., 1913, 1063). Under Int. Conv., Sept. 25, 1913.

THE liquors are concentrated to at least seven-eighths of their original volume before neutralisation and fermentation, whereby much sulphurous acid is removed and a better fermentation attained.—J. H. L.

Wood fibre; Process of and apparatus for obtaining ——. W. K. Freeman, Oscawana, N.Y. Eng. Pat. 28,929, Dec. 15, 1913.

SEE Fr. Pat. 471,620 of 1913; this J., 1915, 119.

Acetyl-cellulose composition; Non-inflammable ——. W. G. Lindsay, New York, Assignor to The Celluloid Co. U.S. Pat. 1,133,385, March 30, 1915. Date of appl., May 5, 1909.

SEE Fr. Pat. 415,517 of 1910; this J., 1910, 1299.

Nitrocellulose solutions; Preparation of threads from ——. E. Berl and M. Isler. Fr. Pat. 473,446, June 12, 1914. Under Int. Conv., June 16, 1913.

SEE Ger Pat. 273,936 of 1913; this J., 1914, 746.

Binding and impregnating materials made from waste sulphite liquors. E. Pollacsek, Spezia, Italy. U.S. Pat. 1,133,499, March 30, 1915. Date of appl., Sept. 10, 1913.

SEE Fr. Pat. 462,429 of 1913; this J., 1914, 248.

Paper; Product for sizing ——. J. A. de Cew. Fr. Pat. 472,662, May 26, 1914.

SEE U.S. Pat. 1,099,168 of 1914; this J., 1914, 785.

Solvents with a basis of furfural. Fr. Pat. 472,423. *See* XIII.

Preparation of lacquers from nitrocellulose or resins. Ger. Pat. 280,376. *See* XIII.

Preparation of lacquers from cellulose derivatives. Ger. Pat. 281,265. *See* XIII.

Material similar to leather. Fr. Pat. 472,852. *See* XV.

A special leather and process of making it. Fr. Pat. 473,380. *See* XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Acid dyebath; Mechanism of the ——. *III. Experiments with Crystal Scarlet.* M. Fort and P. Anderson. J. Soc. Dyers and Col., 1915, 31, 96–100.

IN continuation of previous work (see this J., 1913, 907; 1915, 349), quantitative experiments were made with pure Crystal Scarlet and sulphuric acid, using two qualities of wool, viz., a dry-combed merino-sliver, scoured with neutral soap, and a thick fingering yarn made from a coarse long-stapled, cross-bred wool. In similar experiments, the cross-bred yarn took up more acid and more Crystal Scarlet from a neutral bath, than the

merino sliver. The interchange of acid and dyestuff was found to take place in approximately equimolecular proportions in the case of the sliver, but the results were not so satisfactory in the case of yarn. It is not to be implied that the free colour acid is not formed in any acid dyebath, but such action is not an essential part of the dyeing process, which proceeds as follows: wool basic hydrate. $H_2SO_4 + C_{20}H_{12}N_2S_2O_2Na_2 \rightleftarrows$ wool basic hydrate. $C_{20}H_{12}N_2S_2O_2H_2 + Na_2SO_4$. The different factors in the equilibrium may be varied, e.g., dyeing may be retarded by increasing the amount of sodium sulphate, stripping with which, however, only takes place to an equilibrium (Knecht; J. Soc. Dyers and Col., 1905, 250). The common assumption that sulphuric acid in the dyebath first liberates the free colour acid from an acid dyestuff, is not supported by the authors' results.—F. W. A.

Microscopical studies on cotton. Herzog. *See* V.

PATENTS.

Dyeing artificial silk. S. Heap and Son, Ltd., and W. Marshall, Rochdale. Eng. Pat. 15,820, July 2, 1914.

IN dyeing fabrics containing artificial silk, either in hanks or in the piece, with basic dyestuffs, better results are obtained by first treating with a tannin bath, and then with the dyestuff before the treatment with tartar emetic or other metallic salt. —F. W. A.

Dyeing fur and hair: Process for ——. Akt.-Ges. für Anilin-Fabrikation. Fr. Pat. 472,702, May 26, 1914. Under Int. Conv., Dec. 20, 1913.

DERIVATIVES of dialkylaminodiphenylamine of the general formula $(alkyl)_2N.C_6H_4.NH.C_6H_4.R'(3)$ are used, in which R' is NH_2, $N(CH_3)_2$, $N(C_2H_5)_2$, OH, etc. The dyeing process is carried out as usual, in presence of an oxidising agent, for example, hydrogen peroxide, but alkali is not added to the dye-bath; the skin may or may not be mordanted. The grey dyeings obtained are very fast to light.—F. W. A.

Dyes on the fibre: Production of ——. Akt.-Ges. für Anilin-Fabrikation. Fr. Pat. 473,141, June 13, 1914. Under Int. Conv., Dec. 31, 1913.

DYESTUFFS are produced on the fibre by combining 1-nitroaryl-3-methyl-5-pyrazolone with a diazotised aromatic amine. Very bright yellow shades are obtained with diazo-compounds of the benzene series. White discharges may be obtained with rongalite, whereas this is not possible, even in presence of anthraquinone as catalyst, with 1-phenyl-3-methyl-5-pyrazolone.—F. W. A.

Textile fabrics; Treatment [waterproofing] of open-mesh ——. M. Ratignier, Lyon, France. U.S. Pat. 1,133,062, Mar. 23, 1915. Date of appl., April 21, 1913.

OPEN-MESH fabrics are waterproofed by impregnating with an alcoholic solution containing gum lac, amyl acetate, and collodion, and allowing the treated fabric to dry slowly.—F. W. A.

Impregnation of fibrous material and textiles [with rubber solutions, etc.]; Process for the ——. J. D. Tew. Fr. Pat. 472,844, May 30, 1914.

IN impregnating textile materials with rubber solutions, better results are obtained by distributing the solution on one side of the material and applying a greater pressure to this side than to the other side of the material. The material is wound on a drum with a hollow, perforated core from which the solution is forced through the successive layers of material. The impregnated material is then dried by hot air distributed in the same manner as the solution.—F. W. A.

Bleaching purposes; Treatment of textile fibres for ——. E. T. J. Watremez, Brussels. U.S. Pat. 1,133,769, March 30, 1915. Date of appl., Feb. 6, 1914.

SEE Fr. Pat. 467,887 of 1914; this J., 1914, 959.

Bleaching, dyeing, and the like: Apparatus for ——. O. and E. H. Sumner, St. Margarets-on-Thames. U.S. Pat. 1,133,759, March 30, 1915. Date of appl., Oct. 7, 1913.

SEE Eng. Pat. 18,817 of 1913; this J., 1914, 959.

Manufacture of insoluble azo dyestuffs. Fr. Pat. 472,889. *See* IV.

Azo dyestuffs and products used in producing them. Fr. Pat. 472,893. *See* IV.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sodium hypochlorite from caustic soda and chlorine; Manufacture of ——. U. Cattania and C. Ranucci. Annali Chim. Appl., 1915, **3**, 161—164.

SODIUM hypochlorite solution (28° B., sp. gr. 1·241) made by the interaction of chlorine and caustic soda solution in an absorption tower, usually contains 8—9% of available chlorine, rarely 10%. The author prepared solutions containing up to 17·7% by bubbling chlorine into caustic soda solution of 28° B. contained in a stoneware vessel provided with an agitator and placed in a tank of cold water. When the concentration of available chlorine reached 7·7%, separation of sodium chloride commenced, and the hypochlorite then gradually decomposed on allowing the solution to stand, but the solutions maintained their strength when the sodium chloride was removed as soon as it separated. A. S.

Nitrites: Analysis of ——. N. Busvold. Chem.-Zeit., 1915, **39**, 214.

IN determining nitrite by the silver bromate method (see this J., 1914, 104) if the amount of sulphuric acid (1 : 1) used exceeds 50 c.c. to about 500 c.c. of liquid, marked reduction of the bromate is effected by the acid. Similarly, the acetic acid concentration should fall between 50 c.c. and 100 c.c. of 2-N acid to 1 grm. of silver bromate and 100 c.c. of water (500 c.c. total volume). The best temperature for the addition of the nitrite solution is about 90° C. Acetic acid may be replaced by succinic and similar acids, but not by oxalic acid. During the reduction it should not be possible to detect oxides of nitrogen by potassium iodide and starch test paper: hence in the final warming with sulphuric acid (1 : 4) it is advisable to add not more than 30 c.c. in the first instance, out of the 50 c.c. permissible. In the presence of air, acetic acid vapour causes a slow development of blue colour in the test paper.—J. R.

Nitrogen: Fixation of atmospheric ——. *The cyanamide process.* W. S. Landis. Amer. Chem. Soc., Mar., 1915. Met. and Chem. Eng., 1915, **13**, 213—220.

THE history of the cyanamide process is briefly outlined and a description given of the plant of the American Cyanamid Co. at Niagara Falls. The process depends on the reversible reaction: $CaC_2 + N_2 \rightleftarrows CaCN_2 + C$, the equilibrium constants of which are not yet definitely established. High-grade materials are necessary for successful operation: ordinary "lighting" carbide is unsuitable; the nitrogen employed is obtained from liquid air. The calcium carbide, crushed to pass a 100-mesh sieve, is treated in small ovens (½—2½ tons capacity), special precautions being necessary to avoid a reversal of the reaction. The product

from the ovens, called "lime nitrogen" and containing about 22% N and 1% of carbide, is finely ground (great care being required to avoid explosion) and stored in silos. For agricultural purposes the finely divided product is partly hydrated to decompose the contained carbide and then "oiled" to render it dustless for storage; this partial hydration requires special attention since, particularly at temperatures above normal, calcium cyanamide tends to become transformed (by the action of water) into a variety of organic compounds of inferior manurial value. Calcium cyanamide is also employed for the manufacture of ammonia, by subjecting a mixture of the material and water to the action of heat and high pressure; for the preparation of powders for case-hardening iron and steel, and for the production of crude sodium cyanide (containing the equivalent of 25% KCN), by melting a special grade of cyanamide with sodium chloride: solutions prepared from this low-grade cyanide have proved to be as efficient for metallurgical purposes as solutions of equivalent strength prepared from higher grade products. A process is now being developed for converting the ammonia obtained from calcium cyanamide into a fertiliser consisting largely of ammonium phosphate. This product, "ammophos," contains over 13% NH_3 and 45—50% P_2O_5, and when mixed with high-grade potash salts will make a complete fertiliser about six times as concentrated as the average grades now available. The world's production of cyanamide (from 14 factories) during 1914 was about 300,000 tons, the present annual output of the Niagara Falls plant being 64,000 tons.—W. E. F. P.

Radium; The industrial uses of ——. T. Thorne Baker. J. Roy. Soc. Arts, 1915, **63**, 490—498. (See also this J., 1914, 35.)

TESTS with mustard seed indicated that germination and growth are promoted by the α rays of the radium emanation, especially when supplied in the form of emanation water; that the β and γ rays are injurious to plant life; and that germination is adversely affected or prevented by the presence of uranium. Radio-active ore residues for agricultural purposes should therefore be purified and standardised as regards radium content before use. An aqueous solution of the product obtained by dissolving radium barium sulphate in molten sodium chloride was found to be superior to ordinary emanation water for external medical use. Photographic emulsions were found to yield much denser and more vigorous results when containing radium chloride or bromide than without this addition. Mention is also made of the use of radium for eradicating fungi on dried fish, in fermentation industries, as a bactericide, and for rendering the hands of clocks, etc., luminescent in the dark. The author advocates the use of radio-active ore residues for many of the purposes for which pure radium salts are at present employed.—W. E. F. P.

Chemical reactions at low pressures. I. Langmuir. J. Ind. Eng. Chem., 1915, **7**, 349—351.

IF a small quantity of gas be introduced into an exhausted bulb containing a highly heated tungsten filament, in almost all cases the gas gradually disappears. At the very low pressures used, viz., 0·0001 to 0·05 mm. of mercury, the temperature of the gas is determined by that of the bulb, and there is no temperature gradient in the gas, in the ordinary sense, even close to the filament, so that it is possible to have the filament reacting with a gas at an entirely different temperature. The experimental results obtained are not in accord with Bodenstein and Fink's theory of heterogeneous reactions (compare this J., 1908, 120), in which it is assumed that the reaction velocity is limited by the rate of diffusion of the gas molecules through an adsorption layer of highly compressed gas on the surface of the solid. A "molecular film theory" has been developed which is in good quantitative agreement with the experimental results. It is assumed that most of the gas molecules striking the bare surface of a filament are held by cohesive force as an adsorption film—usually only one molecule deep—until they evaporate from the surface: a condition of equilibrium is attained when the rates of adsorption and of evaporation are equal. The reaction velocity depends upon the rate at which the gas molecules can come in contact with the active portion of the surface, which may be either the uncovered portion or the adsorption film. It is probable that even at higher pressures than those mentioned above, *e.g.*, at atmospheric pressure, the mechanism of a heterogeneous reaction can be explained better by the "molecular film theory" than by that of Bodenstein and Fink.

The reactions studied may be divided into four classes:—(A) The filament is attacked by the gas. (B) The gas reacts with vapour given off by the filament. (C) The filament acts as a catalyst, producing a chemical change in the gas without itself being permanently altered. (D) The gas is changed chemically, or reacts with the filament, as a result of electrical discharges. The following examples of the first three classes are given:—

(A) *Tungsten filament and oxygen.* Oxygen is adsorbed by the bare filament, forming a layer composed of two modifications in chemical equilibrium with each other. One modification is active and reacts immediately with oxygen to form tungsten trioxide, which distils off, leaving the surface of the filament bright, whilst the other modification is inactive. The rate at which the adsorption film volatilises, is low compared with that at which it is removed by combining with more oxygen. *Carbon filament and oxygen.* Oxygen in contact with a carbon filament heated to 1200° absolute, in part reacts with the carbon to form carbon dioxide, and in part gradually forms an extremely stable adsorption film, which greatly retards the formation of carbon dioxide. The adsorption film decomposes slowly when the filament is heated to 1700° abs. and rapidly at 2100°, in a vacuum, with evolution of carbon monoxide. The adsorption film is also formed when the filament is heated in carbon dioxide, a volume of carbon monoxide equal to that of the carbon dioxide consumed being produced. Carbon monoxide is not adsorbed by carbon at any temperature.

(B) *Tungsten and nitrogen.* Nitrogen does not combine with solid tungsten, but forms a nitride, WN_2, with tungsten vapour; the velocity of the reaction is not affected by the temperature of the bulb. (See also this J., 1914, 245.) *Molybdenum and nitrogen.* Nitrogen combines with molybdenum vapour to form either a stable nitride, MoN_2, or an unstable adsorption compound which decomposes on striking the bulb: the lower the temperature of the reacting gases, the greater the proportion of the stable nitride. *Tungsten and carbon monoxide.* With the bulb at the ordinary temperature carbon monoxide combines with tungsten vapour to form WCO, but if the bulb be cooled below —70° C., the carbon monoxide attacks the solid filament, forming an adsorption film of WCO. The reaction of the gas with the filament has a negative temperature coefficient; its velocity is independent of the pressure of the carbon monoxide and of the temperature of the bulb below —70° C., but is limited by the rate at which the compound can distil off. *Platinum and oxygen.* Analogous to molybdenum and nitrogen, but at higher pressures, *i.e.*, above 1 mm., oxygen attacks solid platinum at a rate increasing with the pressure

(c) *Dissociation of hydrogen into atoms* (see this J., 1914, 919). *Dissociation of chlorine into atoms.* If two tungsten filaments be mounted side by side in a bulb containing chlorine at low pressure, and one of the filaments be highly heated, the cold filament gradually becomes thinner and may finally disappear, whilst the heated filament may become thicker. The chlorine is dissociated into atoms by the heated filament and the atomic chlorine attacks the cold filament, producing tungsten hexachloride, the vapour of which decomposes in contact with the heated filament and deposits tungsten on it. *Oxygen and carbon monoxide in contact with platinum.* The carbon monoxide reacts only with oxygen present as an adsorption film on the surface of the platinum. At low temperatures carbon monoxide is adsorbed preferentially and prevents adsorption of oxygen. As the temperature is raised the adsorbed carbon monoxide evaporates with increasing rapidity and the proportion of oxygen adsorbed, and hence capable of reacting, increases. Eventually a point is reached beyond which the velocity of the reaction diminishes as the temperature is increased, because the adsorbed oxygen distils off before the molecules of carbon monoxide can come in contact with it. *Hydrogen and oxygen in contact with platinum.* Similar to the reaction between carbon monoxide and oxygen.—A. S.

Patents.

Nitric acid; Preparation of highly concentrated ——. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 472,775, May 28, 1914. Under Int. Conv., June 21, 1913.

Nitric acid of the highest concentration may be prepared by the distillation of acid of lower concentration, provided that the latter is stronger than the acid of minimum vapour pressure. The process may be carried out in a still provided with a dephlegmating column, kept at a suitable temperature either by means of a jacket or by means of the nitric acid vapour produced in the still. The vapour of the concentrated acid rises through the column and is condensed and collected. The acid to be distilled may be introduced into the dephlegmating column, and the residual acid of minimum vapour pressure removed from the still continuously.—F. Sp.

Nitric acid; Manufacture of ——. Oesterr. Verein für Chem. und Metall. Produktion. Ger. Pat. 280,967, Jan. 27, 1914. Under Int. Conv., Nov. 5, 1913.

Ammonium nitrate is heated with a quantity of sulphuric acid at least sufficient to form acid ammonium sulphate.—A. S.

Acetic acid; Process for manufacturing —— *from acetylene.* Chem. Fabr. Griesheim-Elektron. Fr. Pat. 473,158, June 8, 1914. Under Int. Conv., June 21, 1913.

Acetic acid may be prepared from acetylene, without isolating the acetaldehyde formed as an intermediate product, by the interaction of acetylene, oxygen, and the requisite amount of water in the presence of mercury compounds, *e.g.*, acetate, sulphate, or phosphate. The reaction is carried out in acetic acid, or in any appropriate organic acid (*e.g.*, chloroacetic or lactic acid) which can be easily separated from the acetic acid formed. Contact substances such as iron oxides or vanadium pentoxide, and accelerating agents such as phosphoric acid, sulphuric acid, or bisulphates, may be employed in addition to the mercury compounds. The best results are obtained by introducing the acetylene and oxygen alternately in small quantities into the acid medium containing the contact substances. If glacial acetic acid is employed, ethylidene diacetate is formed as an intermediate product.—F. Sp.

Phosphoric acid; Purification of commercial ——. M. Melamid and L. Grötzinger. Ger. Pat. 280,969, April 17, 1914.

Commercial phosphoric acid is diluted with water, heated and agitated with tar or tar oils or derivatives in presence of an inert gas or vapour for 2—4 hours, and allowed to settle. The phosphoric acid is drawn off, filtered, and decolorised by filtering through bone charcoal.—A. S.

Kilns for the preparation of chlorosulphonic acid and for similar purposes. Wülfing, Dahl u. Co. Fr. Pat. 472,612, May 23, 1914. Under Int. Conv., May 24, 1913.

The cast iron parts of kilns subjected to the corrosive action of acid vapours and hot salt particles are protected by a lining of wrought iron. —W. H. H. N.

Washing compounds. J. T. Freestone, and W. F. Walker, Ltd., Liverpool. Eng. Pat. 19,229, Aug. 29, 1914.

A mixture of 150 to 300 parts of sodium perborate and 200—400 parts of soda ash, with or without 75—125 parts of borax, with 20—40 parts of petroleum of flash point over 73° F. (23° C.), is pressed into a block and coated with paraffin wax to protect the ingredients from external moisture and decomposition.—W. H. H. N.

Silicate of soda or the like; Process of clarifying liquid ——. J. G. Vail, Chester, and J. D. Carter, Lansdowne, Pa. U.S. Pat. 1,132,640, March 23, 1915. Date of appl., May 1, 1914.

The liquid is heated, without agitation, and preferably under pressure, in a closed vessel from which it may be withdrawn through a cooling coil.—F. Sodn.

Gases; Neutralising corrosive [sulphuric acid] fumes in ——. T. E. Murray and E. B. Ricketts, New York. U.S. Pat. 1,132,679, March 23, 1915. Date of appl., Oct. 14, 1914.

Air containing sulphuric acid fumes is passed through a thin sheet of sodium carbonate solution, then with the entrained liquid through an adjacent parallel foraminous screen, and finally through a second parallel sheet of sodium carbonate solution. —W. F. F.

Aluminium oxide from sulphate of alumina; Production of ——. G. Schwahn, Belleville, Ill. U.S. Pats. (A) 1,132,736, and (B) 1,132,737, March 23, 1915. Dates of appl., Dec. 12, 1908, and Jan. 15, 1912.

(A) Porous anhydrous aluminium sulphate is heated in the presence of steam, at a uniform temperature above the dissociating point of sulphuric acid. The sulphate may be heated in one part of a retort or furnace, and steam, generated or superheated in another part, conveyed through the incandescent material until pure alumina remains. (B) A relatively thin moving mass of porous aluminium sulphate, exposing a large heating area, is rapidly and uniformly heated to incandescence in the presence of air, and steam is then passed through the mass until all sulphuric acid is removed.—F. Sodn.

Nitrogen compounds; Process for making ——. G. Coutagne. Fr. Pat. 472,465, Aug. 5, 1913.

Nitrogen and air mixed with hydrogen or hydrocarbons are passed beneath the surface of a mixture of bauxite and carbon in powdered or granular form, raised to the necessary temperature by an electric current passing through the walls of the containing crucible. The heat produced by burning excess carbon and the combustible gas constituent, maintains the mass at the reaction

temperature, and the gases pass up through the heated crust where aluminium nitride is formed. —W. H. H. N.

Potash; Extraction of —— from saline deposits containing small quantities. M. E. Pichard. Fr. Pat. 472,503, Aug. 6, 1913.

THE salt is treated with a cold saturated solution of sodium chloride containing sufficient sodium nitrate to convert the potassium into nitrate. The solution is concentrated, and potassium nitrate containing sodium chloride separates on cooling. The former is recovered by leaching with hot water.—W. H. H. N.

Substances capable of exchanging their bases; Manufacture of ——. Water Softeners (France), Ltd. Fr. Pat. 472,533, May 20, 1914.

THE substances contain groups of the type.

$$(NaO)_2Si <^{O.Si(OH)_2.O.Al(OH)}_{O.Si(OH)_2.O.Al(OH)}> O$$

in which the alumina may be replaced by other isomorphous oxides and the silicon by titanium, thus producing bodies not containing aluminium and silicon. The kaolin portion of the complex may be replaced by other silicates, or by titanates, etc. Such substances may be obtained, for example, by heating aluminium silicates with alkalis and treating the product with water. —J. H. J.

Oxides of nitrogen; Catalytic oxidation of ammonia to ——. Verein Chem. Fabriken in Mannheim. Fr. Pat. 492,567, May 22, 1914. Under Int. Conv., May 28, 1913.

AIR and ammonia are forced through the catalyst so that the pressure of the products as they leave is greater than that of the atmosphere. This may be attained, for instance, by placing a perforated plate after the catalyst.—W. H. H. N.

Oxides of nitrogen; Preparation of —— by oxidation of ammonia in presence of catalysts. Badische Anilin und Soda Fabrik. Ger. Pat. 280,199, Jan. 31, 1913.

THE reacting gases, if they have been in contact with material capable of yielding dust-like particles, are purified thoroughly immediately before coming in contact with the catalyst; or the purified gases on their way to the catalyst are brought in contact only with materials, *e.g.*, nickel or high-grade nickel alloys, not capable of yielding dust-like particles.—A. S.

Colloidal hydroxides of osmium and ruthenium; Preparation of —— and of the colloidal metals. Kalle und Co., A.-G. Ger. Pat. 280,365, July 30, 1913. Addition to Ger. Pat. 248,525 (this J., 1912, 952).

THE tetroxide of osmium or of ruthenium is mixed with a protective colloid, such as sodium protalbinate or lysalbinate, and with alcohol, and the mixture evaporated carefully to dryness. The solid colloidal hydroxide thus obtained may be reduced to the colloidal metal by means of hydrogen at a low temperature. A. S.

Magnesium carbonate from calcareous magnesium carbonates and magnesium silicates; Manufacture of ——. A. Hambloch and S. Gelleri. Ger. Pat. 280,738, Dec. 25, 1913.

THE raw or calcined mineral is ground, mixed with alkali carbonate or bicarbonate, treated with water saturated with carbon dioxide, and then heated to 60°–70° C. The precipitated calcium carbonate and other insoluble matter is separated, and the solution, containing the magnesium in the form of a double carbonate, is heated, whereupon magnesium carbonate is precipitated, leaving a solution of alkali carbonate.—A. S.

Hydrogen: Manufacture of —— in iron and steel works. H. Dieke. Ger. Pat. 280,964, Aug. 14, 1913.

HYDROGEN is produced by the action of steam on scrap from the various departments of an iron and steel works, and the resulting iron oxide is utilised in the blast-furnace or open-hearth furnace.—A. S.

Alkalis and an aluminium silicate suitable for cement manufacture; Process for obtaining —— from natural double silicates. R. van der Leeden. Ger. Pat. 281,006, March 5, 1914.

NATURAL double silicates are heated with a quantity of calcium chloride approximately equivalent to their alkali content, or an equivalent quantity of a waste product containing calcium chloride, and with a small quantity of a reducing agent, *e.g.*, carbon.—A. S.

Nitric acid: Process for concentrating dilute ——. E. Collett, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. U.S. Pat. 1,133,840, March 30, 1915. Date of appl., Oct. 13, 1913.

SEE Eng. Pat. 22,746 of 1913; this J., 1914, 482.

Salt; Process and apparatus for converting rock —— into table salt. L. W. Damman, Zwolle, Netherlands. Eng. Pat. 10,304, April 25, 1914. Under Int. Conv., Sept. 17, 1913.

SEE Ger. Pat. 276,344 of 1913; this J., 1915, 138.

Ammonium sulphate; Production of ——. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,086, March 23, 1915. Date of appl., Jan. 21, 1913.

SEE Eng. Pats. 12,845 and 14,414 of 1912; this J., 1913, 363.

Hydrogen; Purification of ——. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,087, March 23, 1915. Date of appl., Dec. 4, 1913.

SEE Eng. Pat. 14,509 of 1913; this J., 1914, 256.

Sulphur from pyrites and other metallic sulphides; Production of ——. W. A. Hall, New York. U.S. Pat. 1,133,636, March 30, 1915. Date of appl., June 25, 1913.

SEE Eng. Pat. 8279 of 1913; this J., 1914, 485.

Boron; Manufacture of ——. Comp. Franç. pour l'Exploit. des Proc. Thomson-Houston. Eighth Addition, dated April 30, 1914, to Fr. Pat. 377,683, May 8, 1907. Under Int. Conv., May 2, 1913.

SEE Eng. Pat. 15,757 of 1913; this J., 1914, 692.

Hydrosulphites; Direct preparation of anhydrous —— from aqueous solutions. Chem. Fabr. Griesheim-Elektron. First Addition, dated May 9, 1914, to Fr. Pat. 460,610, June 23, 1913. Under Int. Conv., Sept. 27, 1913.

SEE Ger. Pat. 279,389 of 1913; this J., 1915, 355.

Alkali compounds; Manufacture of soluble —— from alkali-bearing rocks or products of devitrification. P. and M. Radmann. Fr. Pat. 472,722, May 27, 1914. Under Int. Conv., May 31, 1913.

SEE Eng. Pat. 12,136 of 1914; this J., 1915, 138.

Gases rich in sulphur dioxide; Process and apparatus for the purification of ——. L. P. Basset. Fr. Pat. 472,956, Aug. 27, 1913.

SEE Eng. Pat. 20,667 of 1913; this J., 1915, 28.

Sulphur from gases rich in sulphur dioxide; Process and apparatus for the extraction of ——. L. P. Basset. Fr. Pat. 472,957, Aug. 27, 1913.

SEE Eng. Pat. 20,716 of 1913; this J., 1915, 28.

Seaweeds: Preparation of products from ——, *and their application to the treatment of paper, textiles, leather, etc.* T. Ingham. Fr. Pat. 473,373, June 12, 1914. Under Int. Conv., June 14, 1913.

SEE Eng. Pat. 13,777 of 1913; this J., 1914, 689.

VIII.—GLASS; CERAMICS.

Zirconia: Refractory properties of ——. H. C. Meyer. Met. and Chem. Eng., 1915, **13**, 263—266.

NATURAL zirconia (100-mesh) containing ZrO_2 84·4, SiO_2 7·74, Fe_2O_3 3·40, TiO_2 1·24, and Al_2O_3 0·66%, —the remainder being mainly "loss on ignition" was only slightly vitrified at about 1830° C. and had a small shrinkage. At 1427° C., the linear shrinkages of pure zirconium oxide (99% ZrO_2), wet-ground natural zirconia, and purified natural zirconia (95% ZrO_2) were each 9%; a mixture of 60 parts of 80-mesh zirconia with 40 of wet-ground zirconia, had a linear shrinkage of 3%; and a mixture of 93 parts of purified zirconia with 7 of very refractory kaolin a shrinkage of 12%. Of various binding agents tested, wet-ground zirconia was the most satisfactory. A mixture of 80-mesh zirconia with 5% of good fireclay ("Warrior Ridge") as bonding material withstood a temperature of 1800° C.; tested in the form of standard bricks under furnace conditions, this mixture was superior to magnesite, but inferior to carborundum, as regards shrinking, cracking, and behaviour in contact with carbon. Owing to the low thermal conductivity of zirconia (much less than that of magnesite), crucibles, etc., made of this material require to be considerably thinner than when made of clay, but the danger of breakage through handling is minimised by the high tensile strength of zirconia when properly bonded and fired.—W. E. F. P.

Glazes: Coefficients of expansion of ——. R. Rieke and W. Steger. Sprechsaal, 1914, **47**, 577, 585, 593, 601. Z. angew. Chem., 1915, **28**, Ref., 22—23.

THE effects of varying the proportions of alumina, silica, and boric acid whilst keeping the RO-content constant were studied, using as a basis a glaze of the composition (0·3CaO,0·7PbO) 0·2Al_2O_3(2·1SiO_2,0·4B_2O_3). The coefficient of expansion between the ordinary temperature and 100° C. was diminished by increasing the content of silica, by substituting silica for an equivalent quantity of boric acid, and by alumina up to a content of 0·3 mol. It was increased by increasing the content of boric acid and, in the case of borate glasses free from silica, by proportions of alumina exceeding 0·2 mol. The coefficient of expansion of borate glasses containing very little or no silica, was diminished by increasing the content of boric acid. There was no direct relation between the coefficients of expansion of the glazes and their behaviour when applied to pottery bodies.—A. S.

PATENTS.

Lenses, plates, prisms, and the like; Manufacture of ——. A. J. Davis, Birmingham. Eng. Pat. 10,488, April 28, 1914.

ONE side of a sheet of ordinary coloured sheet glass is coated with a thin layer of a silicious cement to which clear lead or other glass, applied subsequently in a molten or plastic condition, will adhere.—W. C. H.

Argillaceous ceramic pastes; Process of treating —— *in the dry way.* E. Tuschhoff. Fr. Pat. 473,001, Aug. 30, 1913.

VERY finely ground ceramic materials to which a small quantity of water, oil, or other liquid is added, are kneaded, in a machine capable of exerting a pressing action, into lumps which are then sifted and granulated and can be moulded into tiles, etc., in presses.—W. C. H.

Enamels free from boric acid and composed of silicates of alumina, soda, and lime, containing fluorine; Process of enamelling cast- and sheet-iron articles by means of ——. C. Musiol. Fr. Pat. 473,395, June 12, 1914.

THE enamels, used like ordinary bright and coloured glazes, are free from boric acid and consist of a vehicle of silicate of alumina, soda, and lime mixed with fluorides; the usual colouring and clouding materials are added as required.
—W. C. H.

IX.—BUILDING MATERIALS.

Puzzuolana mortars in sea water; Change of composition of ——. G. Giorgis and G. Cenni. Annali Chim. Appl., 1915, **3**, 168—181.

SAMPLES of puzzuolana mortars which had been immersed in sea water—one from about 60 A.D. and five others from 1886, 1888, 1888, 1893, and 1897 respectively—were analysed. Comparison of the results with the probable composition of the original mortars showed that in all cases a portion of the lime had been removed from the mortar by the action of sea water, but that after some time this action had ceased, for the percentage of lime remaining was of the same order in the sample dating from 60 A.D. as in the others. The quantity of alkalis had diminished in all cases, whilst that of magnesia showed no appreciable change in four samples and an increase and decrease respectively in the two others.—A. S.

PATENTS

Artificial stones: Furnaces for use in the manufacture of ——. J. W. Hughes, Narberth, Pa., U.S.A. Eng. Pat. 14,458, June 16, 1914.

THE furnace consists of an annular tunnel kiln with a travelling hearth on to which the articles are delivered by means of an endless chain conveyor moving transversely. The burned articles are removed in a similar manner by the returning half of the same conveyor.—A. B. S.

Bricks from sand; Manufacture of ——. J. F. Léger. Fr. Pat. 472,532, May 20, 1914. Under Int. Conv., May 24, 1913.

BRICKS are made by pressing a mixture of 8 parts of sand, 1 part of barium sulphate, and 1 part of calcined magnesia, together with sufficient magnesium chloride solution to form a bond. The bricks may be used after drying for 24 hours in the open air and are quite dry after a week's exposure; they are impervious, and are not affected by water. Argillaceous sand must not be used.—A. B. S.

Bricks, tiles and slabs with a cork basis; Manufacture of ——. J. F. Léger. Fr. Pat. 472,639, May 25, 1914. Under Int. Conv., May 28, 1913.

BRICKS and other articles made of cork compositions usually deteriorate rapidly by absorption of

moisture. This is avoided by pressing the articles from a mixture of granulated cork and calcined magnesia to which is added a solution of magnesium chloride. Articles so made are fireproof and as resilient as other cork mixtures.—A. B. S.

Bricks; Manufacture of refractory ——. J. F. Léger. Fr. Pat. 472,640, May 25, 1914. Under Int. Conv., May 28, 1913.

A MIXTURE of granulated and powdered silica and calcined magnesia with a solution of magnesium chloride is used for making refractory bricks infusible at the temperature of the blast-furnace. —A. B. S.

Cement; Process of manufacture of a special —— not decomposed by sea water or by sulphate or magnesian waters. A. Klein. Fr. Pat. 472,619, May 23, 1914.

THE clinker before being ground is mixed with from 5 to 20% of an anhydrous oxide of magnesium, copper, iron, tin, aluminium, lead, nickel, or zinc, preferably with 10% of iron oxide.—W. C. H.

Wood; Drying —— by means of smoke. H. J. B. Teillard, jun. Fr. Pat. 473,192, March 9, 1914.

THE wood is placed on racks in a closed chamber into which smoke is delivered from an external stove by means of an inclined pipe. An exit flue is provided near the floor in the opposite wall of the drying chamber, this flue being connected to a vertical pipe extending above the top of the chamber. The action of the smoke does not depend on its heat, but on its chemical properties. The wood can be dried by means of smoke in from 1 to 2 months, as compared with 6—8 months for drying with steam, and 1—1½ years for drying in the open air. Fumigation is also the cheapest method, and it destroys larvæ, etc.—A. B. S.

Wood; Method of dyeing, impregnating, or softening —— at high temperature, and preventing the destruction of the wood during such process. L. Petersen-Hviid, Kastrup, Denmark. Eng. Pat. 29,614, Dec. 23, 1913. Under Int. Conv., Dec. 30, 1912.

SEE Fr. Pat. 466,768 of 1913; this J., 1914, 965.

Process for obtaining alkalis and an aluminium silicate suitable for cement manufacture from natural double silicates. Ger. Pat. 281,006. *See* VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

[*Steel.*] *Comparative study of single-impact, repeated-impact, rotatory-bending and alternating-bending tests.* M. Nusbaumer. Rev. Mét., 1914, **11**, 1133—1190.

SPECIMENS of a series of industrial steels, after different thermal treatments, were tested in a Stanton-Bairstow repeated-impact testing machine, in a modified Wöhler machine, and in a machine devised to bend backwards and forwards in the same plane a test-piece secured at one end (vibration tests). The machines used are described in detail. *Normalised steels.* The endurance of the normalised steels was proportional to the carbon content for the Wöhler (rotary-bending) and vibration tests. Under repeated-impact tests the same relation held for carbon values below 0·25—0·30%, but was reversed for higher carbon values. The low-nickel steels possessed greater endurance than the iron-carbon steels under repeated-impact and vibration tests; no Wöhler tests were made. The high-nickel steels were not superior to the iron-carbon steels of moderate hardness; no Wöhler or vibration tests were made. The nickel-chrome steels showed even greater endurance under repeated-impact and vibration tests than the nickel steels, and of the nickel-chrome series the softest steel always gave the best results; no Wöhler tests were made. *Quenching followed by annealing* increased the endurance of the iron-carbon and the low-nickel steels under repeated-impact and vibration tests, but tended to diminish that of the nickel-chrome steels; no Wöhler tests were made, nor were the high-nickel steels tested. *Quenching without subsequent annealing* increased the endurance of the mild iron-carbon steels, and particularly that of the low-nickel steels under repeated-impact tests. The nickel-chrome steels were also improved, particularly the cemented nickel-chrome steels. The endurance of the high-carbon iron-carbon steels and of the high-nickel steels was diminished. Quenching decreased considerably the endurance under vibration tests of the iron-carbon and the low-nickel steels. It improved, on the contrary, the nickel-chrome steels. No Wöhler tests were made, nor were the high-nickel steels tested. The results showed that the endurance of a given steel under any form of repeated-stress is in accordance with the resistance under the single-impact (Frémont) test; that under any form of repeated-stress a steel may be fractured when working below the elastic limit, if the test is continued for a sufficient time; and that under all forms of repeated-stress, fracture is produced by progressive cracking.—T. ST.

Steel; Brittleness of mild —— produced by working it at "blue" heat. E. Preuss. Stahl u. Eisen, 1914, **34**, 1370—1374. Z. angew. Chem., 1915, **28**, Ref., 40.

THE brittleness of mild steel was found to be increased to a remarkable degree by small tensile stresses (elongations of 1·7, 4·2, or 8·3% respectively) at 250° and, especially, at 300° C. The brittleness increased rapidly with the stress applied, and was not accompanied by any perceptible change in the microstructure of the metal.—A. S.

Chromium and vanadium in steel; Determination of ——. C. H. Rich and G. C. Whittam. Met. and Chem. Eng., 1915, **13**, 238—239.

DUPLICATE determinations of chromium and vanadium may be completed in less than an hour by the following combination of the methods of Walters and Kent Smith (Met. and Chem. Eng., 1911, **12**, [5]; see also this J., 1906, 138):—1—2 grms. of the steel is dissolved in 40—60 c.c. of sulphuric acid, 2—3 c.c. of nitric acid added, and the solution boiled and diluted to 170—180 c.c.; 20 c.c. of silver nitrate solution (1·33 grms. per litre) is then added, and the liquid boiled during the addition of successive small portions of moist ammonium persulphate until the chromium is completely oxidised, as indicated by the precipitation of manganese dioxide or the persistence of a pink tint in the liquid. After further boiling to decompose the excess of persulphate, about 2 c.c. of hydrochloric acid is added, the liquid boiled until chlorine is completely expelled, cooled, and diluted to 400 c.c. A measured volume of $N/10$ ferrous sulphate is then added, the excess of the latter titrated with $N/10$ permanganate (standardised against sodium oxalate), and the percentage of chromium calculated. The titrated solution is prepared for the determination of vanadium by discharging the pink colour with ferrous sulphate, adding 1 or 2 drops of permanganate and then exactly discharging the pink tint by the addition of $N/20$ ferrous sulphate. A measured

volume of the latter is then added and the excess titrated with standard potassium bichromate, the end point being the first appearance of the momentary flush produced in a small drop of potassium ferricyanide solution by a drop of the assay liquid. The relative values of the solutions employed in each determination are found by control determinations on 2 grms. of plain carbon steel under the conditions of assay; but it is usually more convenient to ascertain these relations in acidified water solutions and then make allowance in the analysis for "blanks" determined in solutions of plain carbon steel, the latter being consistent and only requiring verification at intervals. Accurate results were obtained in determinations made on synthetic and standard steels containing up to 6·22% Cr and 0·25% V.—W. E. F. P.

Manganese in the blast-furnace; Reduction of ——. H. Thaler. Stahl u. Eisen, 1914, **34**, 1481—1484. Z. angew. Chem., 1915, **28**, Ref., 39.

An experimental investigation of the manufacture of spiegel with 6·02, 10·83, 12·90, and 20·32% Mn respectively, led to the following conclusions:—Manganese is reduced both directly by carbon, and indirectly, and the fuel consumption increases with the amount of manganese reduced. Reduction is promoted by a high temperature and by slow passage of the charge through the furnace. The proportion of manganese recovered in the spiegel, expressed as a percentage of the amount in the charge, increases with the purity of the manganese ore and the manganese content of the spiegel. The slag should have a basicity corresponding to a 0·8 to 1·0-silicate. Under normal conditions the loss of manganese in the slag is a function of the quantity of slag; it diminishes as the manganese content of the spiegel increases. Loss of manganese by volatilisation is small in the case of low-grade spiegel, but rises rapidly with increasing reduction of manganese, amounting to 7—8% for 20% spiegel. The loss of manganese in the flue dust does not, as a rule, exceed 1%.—A. S.

[*Gold.*] *Cyanide plants; The effect of mineralised waters in* ——. T. B. Stevens and W. S. Bradley. Inst. Min. and Met., April 15, 1915. [Advance proof.] 14 pages.

At the Sons of Gwalia mine (W. Australia), the best practical conditions for using the local water supply were ascertained. The "fresh water" was obtained from shallow wells and the "salt water" from the drainage of underground workings. The salt water contained $CaSO_4$ 3·584, $MgCl_2$ 6·317, $MgSO_4$ 2·760, and NaCl 42·972 grms. per litre. Until recently salt water only was used in the plant, the sand from the battery being treated with 0·3 and the slime with 0·07% cyanide solution. The use of protective alkali was not economically possible, as 12 lb. of pure lime was required per ton of salt water; but by adding 2 lb. per ton of ore the cyanide consumption was reduced owing to the protective action of magnesium hydroxide. The addition of a small quantity of fresh water caused the deposition of considerable magnesium hydroxide and calcium sulphate on the zinc shavings, due to the dilution of the sodium chloride. Experiments made with fresh water proved that it was far more satisfactory, and that the bicarbonates consumed more cyanide than the other cyanicides present; this was counteracted by adding a sufficiency of lime.—W. R. S.

Cyanide solutions; The precipitating action of carbon in contact with auriferous ——. W. R. Feldtmann. Inst. Min. and Met., April 15, 1915. [Advance proof.] 15 pages. (See also this J., 1913, 1014.)

The graphitic schists of West Africa are known to precipitate gold from cyanide solutions. The results of experiments are given showing that this precipitating action is closely analogous to that of wood charcoal: in both cases there is no visible coating on the precipitant, and the precipitated gold is insoluble in cyanide, but soluble to a large extent (about 75%) in sodium sulphide solution, with simultaneous formation of sodium thiocyanate in molecular excess of the precipitated gold. From gold chloride solution, on the other hand, gold is precipitated as a visible metallic coating, soluble in cyanide. After treatment with alkali sulphide, the precipitating power of both schist and charcoal is renewed practically in its entirety. It is suggested that the gold is precipitated in combination with cyanogen, possibly as a "carbonyl aurocyanide." It may be possible to recover gold from graphitic cyanide tailings by sodium sulphide, using copper as a precipitant.—W. R. S.

Gold bullion; Refining ——. T. K. Rose. Presidential Address. Inst. Min. and Met., Feb. 18, 1915. 21 pages.

Three processes for refining gold bullion are at present in use on a large scale: (1) boiling with sulphuric acid, (2) treatment of the molten metal with chlorine gas, (3) electrolytic refining. Two modifications of the electrolytic process are used: the silver nitrate process for alloys rich in silver, and the gold chloride process for alloys rich in gold. In the latter, or Wohlwill, process the electrolyte contains gold chloride and free hydrochloric acid; the anode consists of the impure bullion, the silver of which is converted into chloride which deposits as slime and coats the anode. If more than 6% of silver is present in the latter, it becomes necessary to remove the coating of chloride: by superposing on the direct current an alternating current of greater voltage (pulsating current), the coating is stripped off and falls to the bottom. The gold dissolves in the form of auric and aurous chlorides, the latter being decomposed by water with formation of finely divided gold: $3HAuCl_2 = 2Au + HAuCl_4 + 2HCl$. The anode sludge therefore contains gold in amounts increasing with the temperature of the bath. At the Denver mint, with a temperature of 65° C., the amount of gold found in the slime was 11·37% of that deposited on the cathode; with a cold bath it is less than 1%. A cascade system of mixing is to be adopted in the New York refinery for maintaining uniform concentration; the use of a propeller reduces the fineness of the deposit, as it drives particles of silver chloride against the cathode, where they adhere. Platinum is not dissolved unless alloyed, when it passes into the solution and remains there; palladium behaves similarly. The current density used in practice is 400—500 amp. in Germany, and 700—1000 amp. per sq. metre in the United States, the amount of free hydrochloric acid varying between 5 and 10%. The author's experiments go to prove that with 20—30% of acid a current density of 3000—5000 amp. may be maintained, practically no gold passing into the slime. The amount of gold present as chloride is 5—7%: if increased to 20% a higher current density may be used, and the metal forms a yellow coherent sheet. The electrolytic method yields the purest product at low working cost, but the time of treatment is much longer than in the other processes, and 50% of the gold undergoing treatment is locked up in the plant.—W. R. S.

Platinum plating. G. Nikolaus. Elektrochem. Zeits., 1914, **21**, 193—195. Z. angew. Chem., 1915, **28**, Ref., 37.

A pure, white deposit can be obtained by using a boiling bath composed of 4 grms. of platinic chloride, 20 grms. of ammonium phosphate, 90 grms. of sodium phosphate, and 5 grms. of sodium chloride to 1 litre of water. The article

to be plated should be suspended between two anodes and kept in motion. The potential difference should be 6—8 volts.—A. S.

Copper cyanide plating solutions. M. C. Weber. Lewis Inst., Chicago. Met. and Chem. Eng., 1915, **13**, 255—256.

By the use of cuprous cyanide for the preparation of plating solutions, the presence of inert salts in the latter is avoided and the efficiency of the baths increased, since solutions highly concentrated in copper can be worked at a relatively low specific gravity. As prepared from cuprous cyanide and the copper salts ordinarily employed, the cost of a plating bath of a given concentration in copper varied as follows :—

Copper cyanide (70% *Cu*)—		
100 lb. copper cyanide	$42.00	
100 lb. sodium cyanide	22.00	
		$64.00 (£13 6s. 8d.)
Copper carbonate (50% *Cu*)—		
140 lb. copper carbonate	$19.60	
239 lb. sodium cyanide	52.58	
		$72.18 (£15 0s. 9d.)
Cupri-cupro sulphite ("*red copper compound*" 40% *Cu*)—		
175 lb. red copper compound	$52.50	
160 lb. sodium cyanide	35.20	
		$87.70 (£18 5s. 5d.)
Copper acetate (31% *Cu*)—		
220 lb. copper acetate	$44.00	
193 lb. sodium cyanide	42.46	
		$86.46 (£18 0s. 3d.)

After continuous use for 2 hours, the first solution was practically unchanged, whereas each of the others required an addition of sodium cyanide to prevent coating of the anode.—W. E. F. P.

Brass; Analysis of ——. B. Koch. Chem.-Zeit., 1915, **39**, 215.

One gram of brass turnings is treated with 15 c.c. of sulphuric acid (1 : 1) and 10 c.c. of nitric acid of sp. gr. 1·20, in the order named, and the solution is boiled until nitrous fumes are completely expelled and crystals of zinc sulphate begin to separate. Distilled water is added to the partly cooled liquid to a total volume of 150 c.c., and the copper is determined as described previously (Chem.-Zeit., 1913, **37**, 873). Solid sodium hydroxide (18 grms.) is stirred into the copper-free solution cooled to about 30° C., potassium cyanide (5 grms.) is added, and the zinc is determined by electrolytic deposition upon the platinum electrode already employed in the copper determination. Concordant results are obtained under any of the following sets of conditions :—

Temp.		Current.		Time.
Start.	End.	Amps.	Volts.	Hours.
70° C.	95° C.	5	6	1
70° C.	85° C.	3	5·5	1½
50° C.	70° C.	1	5	5
50° C.	ord. temp.	0·4	4	left overnight

In the last case the liquid is kept at 50° to 60° C. for about 2 hours before allowing to cool. It is sufficient to wash the deposited zinc with cold water. The electrode holders are coated with asphaltum lacquer.—J. R.

Alloys rich in lead (white metal, type metal, solders, etc.); Electrolytic analysis of ——. I. Compagno. Annali Chim. Appl., 1915, **3**, 161—168.

One grm. of the alloy is treated with 4 c.c. of concentrated hydrochloric acid and 4 c.c. of nitric acid (sp. gr. 1·2), and after a few hours the mixture is heated to expel nitrous fumes. The liquid is poured off and the residual lead chloride is washed by decantation two or three times with cold water acidulated with a few drops of hydrochloric acid. The solution and washings are made alkaline with sodium hydroxide, treated with 30 c.c. of sodium monosulphide solution (sp. gr. 1·225), and with 0·4 grm. of potassium cyanide to retain copper in solution, then boiled, allowed to settle, the solution poured off, and the precipitated sulphides washed by decantation two or three times with hot water to which a few drops of sodium sulphide solution have been added. The lead chloride is dissolved in the smallest possible quantity of hot sodium hydroxide solution, the solution diluted with 15—20 c.c. of hot water, treated with 20 c.c. of sodium sulphide solution and 0·1 grm. of potassium cyanide, and the precipitate washed by decantation as described above. The two sulphide precipitates are collected on the same filter and washed with hot water containing sodium sulphide: the total quantity of sodium sulphide solution used for precipitation and washing is 80 c.c. The solution and washings are concentrated to 130 c.c., and antimony, copper, and tin determined as described previously (this J., 1913, 979). The precipitate, together with the filter paper, is boiled with 25 c.c. of dilute nitric acid (sp. gr. 1·2), diluted with water, the solution decanted, and the residue boiled successively with 25 c.c. of dilute and 20 c.c. of concentrated nitric acid, then collected on a filter, and washed with cold water. In the solution the lead is determined electrolytically as dioxide in the usual way, and iron, zinc, etc., by known methods. Some results obtained by this method with alloys of known composition are tabulated.—A. S.

Zinc smelting; Action of slags and vapours on the muffles (retorts) in ——, *and absorption of zinc oxide by clay.* O. Proske. Metall u. Erz, 1914, **11**, 333—339, 377—385, 412—418, 553—562. Z. angew. Chem., 1915, **28**, Ref., 36.

The formation of zinc-spinel occurs to a larger extent in hand-made than in machine-made retorts; it is diminished greatly by addition of coke to the mass used for making the retorts. During smelting the slag takes up considerable quantities of silica and alumina from the retorts, and a viscous layer, intermediate in composition between the slag and the retort, is formed, which tends to prevent rapid destruction of the latter. It is only at the higher temperatures prevailing towards the end of the distillation that there is any pronounced destructive action of the slag on the retorts. The absorption of zinc oxide by the clay used for making the retorts, and its fixation as aluminate, increases with the pressure, temperature, and time.—A. S.

Tin smelting in Bolivia. R. Pezet. Min. and Eng. World, 1915, **42**, 613.

Practically the whole of the tin ore mined in Bolivia is exported to Europe for smelting. Experiments have recently been made with a Wile electric furnace in smelting Bolivian "barilla" or concentrates producing tin of 98¾% purity directly from the furnace without any refining. The balance was composed of 0·69% antimony and 0·56% iron. The loss of tin in the slag was 1·89%, which represented about 5—10% of the tin charged. The power expended was about 450 kw.-hrs. per ton. The analysis of the concentrates was as follows: Tin, 66·96; iron, 0·92; sulphur, 1·14; silica, 5·24; lime, *nil*; antimony, 0·42%.

Sulphates; Formation and decomposition of —— *during roasting.* B. Dudley, jun. Met. and Chem. Eng., 1915, **13**, 221—226.

Figures and curves (based on the results of other investigators) are given showing the composition of equilibrium mixtures resulting from dissociation of sulphur trioxide at atmospheric pressure; the total equilibrium pressures of sulphur trioxide, sulphur dioxide, and oxygen formed above

various heated sulphates; and the dissociation tensions, up to 800° C., of certain sulphates with respect to sulphur trioxide. The concentrations of the sulphur oxides in the gas in immediate contact with the ore and in the interstices of the ore bed are greater than is shown by the analysis of the furnace gas as a whole, and the composition of the gas in the interstices approaches that of the furnace gas as the depth of ore bed decreases and the rapidity of rabbling increases. Consequently the formation of sulphates in the roasting furnace is promoted by low temperature, thick beds of ore, and slow rabbling, and prevented (or their decomposition assisted) by the opposite conditions.—W. E. F. P.

Monazite and wolframite; Concentration of ——. F. Freise. Metall u. Erz, 1914, **11**, 573—578, 587—594. Z. angew. Chem., 1915, **28**, Ref., 37.

MONAZITE concentrates may be divided into three groups according to the ease with which the monazite may be separated from accompanying minerals by magnetic treatment: those containing garnets, with the exception of iron-alumina garnets, are the most, and those containing tourmaline, olivine, hornblende, and augites are the least refractory, whilst those containing zircons occupy an intermediate position. Iron minerals are best separated by a preliminary magnetic treatment. Roasting increases the magnetic susceptibility of monazite about four-fold and also increases that of most of the coloured accompanying minerals. The magnetic susceptibility of monazite increases with the cerium content but appears to be independent of the thorium content.—A. S.

PATENTS.

Iron for castings; Method of preparing ——. W. G. Kranz, Sharon, Pa., Assignor to The National Malleable Castings Co., Cleveland, Ohio. U.S. Pat. 1,132,661, March 23, 1915. Date of appl., April 17, 1911.

IRON rich in carbon and sulphur is heated in an electric furnace with lime to eliminate the sulphur. The treatment may be continued until calcium carbide forms, by which oxides are removed from the metal, and carbon may also be added.—W. R. S.

Iron or steel from galvanised scrap; Production of ——. K. Albert and O. Schleimer. Ger. Pat. 280,414, Dec. 2, 1913.

THE scrap is melted by adding it to a highly heated bath of molten iron, *e.g.*, in an open-hearth or electric furnace. The zinc is volatilised as metal or as oxide and is recovered as oxide from the furnace gases.—A. S.

[Zinc and lead] sulphide ores: Separation of ——. Amalgamated Zinc (De Bavay's), Ltd., Melbourne, Australia. Eng. Pat. 9019, April 9, 1914. Under Int. Conv., April 11, 1913.

THE ore is submitted to a flotation process, and the concentrate of mixed lead and zinc sulphides is then agitated and aerated in a solution of sodium carbonate (0·2—3%) to obtain a float concentrate rich in zinc and a residue rich in lead. When a frothing agent, such as eucalyptus oil, is used in the preliminary concentration, the mixed sulphides are treated with a solution of sodium sulphide or hydrogen sulphide previous to separation.—W. R. S.

Zinc; Process and electric furnace permitting the extraction, in a state of purity, of —— from its ores. E. F. Côte and P. R. Pierron, Lyons, France. Eng. Pat. 14,192, June 12, 1914. Under Int. Conv., Nov. 19, 1913.

THE ore is reduced in an "arc and resistance" furnace connected to an "indirect resistance" furnace; the zinc vapour passes into the latter, condensing in its upper part in the form of drops and powder on the surface of an electrically heated column of coarse carbon, while the furnace gases, which are the cause of the formation of zinc powder, escape upwards through a stack filled with carbon pieces on which the remainder of the zinc condenses. The lower layer of the carbon column is withdrawn from time to time and replaced at the top by carbon from the stack; the condensed zinc descends with, and is redistilled by, the heated carbon which retains impurities, the zinc vapour passing laterally through pipes leading into a condenser below, where the pure metal collects in the liquid state. —W. R. S.

Zinc; Production of —— by electrolysis. Apparatus for producing zinc, copper, or other metals by electrolysis. M. Perreur-Lloyd. Fr. Pats. (A) 472,763 and (B) 472,764, May 28, 1914.

(A) FOREIGN metals are separated from the zinc solution by passing it through vessels containing waste zinc to precipitate copper, and afterwards over ore rich in zinc oxide, to precipitate iron. Or the zinc only may be dissolved from the ore by sulphurous acid, obtained by roasting zinc blende, the solution containing sulphite or bisulphite being then oxidised to sulphate by air. Bubbles of hydrogen are removed from the deposited zinc by means of rubbing pads having a reciprocating motion. (B) The rotary cathode cylinder is supported between two end discs, in which are adjusted and fixed the ends of the shafts, which turn in stuffing-boxes fixed in the walls of the outer vessel. The anode completely envelops the periphery of the cathode, with the exception of a longitudinal upper space, in which rubbing pads, acting on the outer surface of the deposited metal, are disposed. The longitudinal rod, carrying the rubbing pads, is given a reciprocating motion by means of a bent lever and cam mechanism driven by the cathode shaft, the variation of the pivot of the lever varying constantly the position of the rubbing pads and preventing the formation of striæ on the metal. The anode, consisting of end supports carrying several concentric groups of lead rods, is made in two parts, and the upper portion, together with the longitudinal bar carrying the rubbing pads, may be removed for the withdrawal of the deposited metal on the cathode.—B. N.

[Silver-cadmium] alloys: Process of making ——. E. D. Gleason, Flatbush, N.Y., Assignor to R. H. King, Brooklyn, N.Y. U.S. Pat. 1,133,019, March 23, 1915. Date of appl., July 18, 1911. Renewed May 13, 1912.

A DUCTILE alloy (Ag 55, Cd 45%) is made by heating silver to approximately its boiling point under a layer of flux, adding cadmium, and agitating the molten mass.—W. R. S.

Roasting furnace; Rotary muffle ——. Bunzlauer Werke Lengersdorff und Co. Ger. Pat. 280,428, June 8, 1913.

THE long rotary roasting chamber, mounted at an inclination to the horizontal, is elliptical in cross-section. Along the wide sides of the chamber are two flat roasting hearths, the spaces between the hearths and the wall of the chamber serving as heating flues. Manholes and openings for viewing the interior, fitted with covers, are provided in the narrow sides of the roasting chamber, which are not heated. The material is introduced at one end into, and discharged at the other end from the roasting chamber through fixed cylindrical chambers, the internal diameter of which is shorter than the major axis of the roasting chamber. By varying the diameter of the outlet chamber the

depth of the charge in the roasting chamber, and hence the amount of material passing through in a given time, can be regulated without altering the slope of the furnace.—A. S.

Furnace for obtaining easily oxidisable metals. A. Zavelberg. Ger. Pats. (A) 276,364, Aug. 6, 1913, and (B) 280,524, April 2, 1914. Additions to Ger. Pat. 226,257 (this J., 1910, 1160).

(A) THE furnace is composed of a number of independent reaction chambers or shafts, and tight joints between the walls of adjacent chambers are obtained by means of packing layers of finely ground quartz, asbestos, or the like. (B) A packing layer of finely ground pure silica, *e.g.*, washed sea sand, is used.—A. S.

Furnaces; Electro-metallurgical —— more especially suitable for the manufacture of aluminium and its alloys. Comp. des Prod. Chim. d'Alais et de la Camargue. Fr. Pat. 473,043, Sept. 3, 1913.

THE molten metal in the bottom of the furnace is connected to the negative terminal by a mass of aluminium, of cross-section gradually increasing towards the outside of the furnace, and passing through the base. The heat is thus conducted away sufficiently rapidly, or the mass of aluminium may be cooled by circulation of water, to prevent fusion. —B. N.

Briquettes of fine ores, flue dust, etc.; Manufacture of ——. B. Müller-Tromp. Ger. Pat. 278,105, Dec. 12, 1909.

THE material is mixed with calcined phosphatic chalk and briquetted in a moderately moist condition, with or without addition of quicklime.—A.S.

Oil used for hardening [metals]; Process and apparatus for cooling ——. Dittmann-Neuhaus und Gabriel-Bergenthal A.-G. Ger. Pat. 280,512, May 29, 1914.

WATER is delivered on to the surface of the oil and sinks through it, thereby cooling it. The water flows from the lower part of the hardening tank into a settling vessel to recover the oil.—A. S.

Phosphor-copper; Process for the production of ——. E. Schulte. Ger. Pat. 281,293, March 11, 1913.

MOLTEN phosphorus in measured quantities is forced into a bath of molten copper by hydraulic pressure, with exclusion of air.—A. S.

Alloys of iron. J. R. Speer, Trappe, Md., and W. L. Forster, Rochester, Pa., U.S.A. Eng. Pat. 29,634, Dec. 23, 1913. Under Int. Conv., March 18, 1913.

SEE U.S. Pat. 1,071,364 of 1913; this J., 1913, 947.

Steel; Manufacture of ——. W. G. Nicholls. Fr. Pat. 473,105, June 5, 1914.

SEE U.S. Pat. 1,100,905 of 1914; this J., 1914, 792.

Slags in steel works; Use of collecting vessels for ——. F. Dahl. Fr. Pat. 472,738, May 27, 1914. Under Int. Conv., Jan. 9, 1914.

SEE Ger. Pat. 279,542 of 1914; this J., 1915, 233.

Furnaces; Ore-roasting ——. E. Bracq, Lens, France. Eng. Pat. 11,743, May 12, 1914. Under Int. Conv., May 13, 1913. Addition to Eng. Pat. 20,108 of 1912.

SEE Addition of May 13, 1913, to Fr. Pat. 434,494 of 1911; this J., 1914, 88.

Zinc; Roasting of compounds or ores containing ——. A. L. J. Queneau, Philadelphia, Pa. U.S. Pat. 1,132,684, March 23, 1915. Date of appl., July 19, 1911.

SEE Fr. Pat. 445,233 of 1912; this J., 1912, 1186.

Galvanising-bath. N. K. Turnbull, Manchester. U.S. Pat. 1,132,889, March 23, 1915. Date of appl., Nov. 13, 1913.

SEE Eng. Pat. 9815 of 1913; this J., 1914, 189.

Galvanising wire, hoops, sheets, and the like. H. H. Field, Grappenhall, M. Howarth, Latchford, and E. A. Atkins, Liverpool. U.S. Pat. 1,133,628, March 30, 1915. Date of appl., Feb. 11, 1913.

SEE Eng. Pat. 27,611 of 1912; this J., 1914, 425.

Copper; Electrolytic process of producing ——. M. Perreur-Lloyd, Boulogne, France. U.S. Pat. 1,133,059, March 23, 1915. Date of appl., March 28, 1912.

SEE Fr. Pat. 441,644 of 1912; this J., 1912, 932.

Ores; Process for reducing ——. H. C. Alford. Fr. Pat. 471,898, May 7, 1914.

SEE U.S. Pat. 1,097,156 of 1914; this J., 1914, 698.

Neutralising corrosive [sulphuric acid] fumes in gases. U.S. Pat. 1,132,679. *See* VII.

Preparation of colloidal hydroxides of osmium and ruthenium and of the colloidal metals. Ger. Pat. 280,365. *See* VII.

Manufacture of hydrogen in iron and steel works. Ger. Pat. 280,964. *See* VII.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Furnaces; Electric resistance ——. G. Gmür-Zehnder, Aarau, Switzerland. Eng. Pat. 23,495, Dec. 3, 1914.

THE refractory material under treatment is placed in a central tube clear of the current circuit, and enclosed within two concentric heating tubes mounted between top and bottom conducting blocks. The concentric tubes may be raised vertically to open the furnace, and a cooling air blast is simultaneously brought into action upon the tube containing the heated material.—B. N.

Furnace; Electric —— with several fusion hearths, and electrodes of different polarity vertically above the hearths. Helfenstein Elektro-Ofen-G. m. b. H. Fr. Pat. 473,416, June 13, 1914. Under Int. Conv., June 14, 1913.

THE furnace vessel, comprising several chambers containing electrodes, is surmounted by a common charging vessel, formed in a single piece by prolonging the furnace walls. The escaping gases are withdrawn from the charging vessel through tubes passing laterally through the walls or down into the interior, the material above the mouths of the tubes preventing the entry of air. The electrodes are separated in the charging vessel by partitions, which prevent the lateral passage of the current between the electrodes, and permit the replacement of electrodes of one phase without interrupting the working, and without entry of air into the other chambers. Each electrode, together with its mounting, is completely surrounded by an insulating sleeve.—B. N.

Plate for electrical or secondary batteries or accumulators. E. Hancock and D. David, Cardiff. U.S. Pat. 1,133,611, March 30, 1915. Date of appl., Aug. 25, 1911.

SEE Eng. Pat. 19,109 of 1913; this J., 1914, 1096.

Ozoniser, and sterilisation of water by ozone. Fr. Pat. 473,181. *See* XIXB.

XII.—FATS; OILS; WAXES.

Oil-seed: A new —— from S. America. E. M. Jesson. Bull. Miscell. Inform., Roy. Botan. Gard., Kew, 1914, No. 9, 333—334. Bull. Bureau Agric. Intell., 1915, **6**, 75.

A SHIPMENT of the seeds of *Osteophlœum platyspermum*, Warb. (*Myristica platysperma*, Spruce), a tree indigenous to N.W. Brazil, was recently received at Liverpool. On extracting with petroleum spirit, a white, crystalline fat with very little smell was obtained. The kernels of one sample gave 55·2% of fat, with m. pt. 43° C., and solidif. pt. 39° C., iodine value (Wijs) 6·3%, saponification value 240·2, refractometer reading at 40° C., 36·9. The oil contained 5·3% of free fatty acids (as oleic acid). The inner shell of the fruit is brittle and easily crushed.—E. H. T.

PATENTS.

Oil and the like; Detoxicating —— [previous to hydrogenation]. C. Ellis, Montclair, N.J. U.S. Pat. 1,132,710, March 23, 1915. Date of appl., Aug. 15, 1913.

THE oil or fat is exposed, in the absence of hydrogen, to the action of a spent catalyst, which will absorb or combine with substances injurious to the catalytic action, and is then hydrogenated in the presence of an active catalyst.—C. A. M.

Precipitation tank [for oil]. W. L. Morris, Assignor to S. F. Bowser and Co., Fort Wayne, Ind. U.S. Pat. 1,129,893, March 2, 1915. Date of appl., Feb. 16, 1912.

A VERTICAL cylindrical tank for clarifying oil has a conical bottom with a sediment-discharge pipe, and a number of inlet pipes around the circumference near the bottom, each provided with a deflector to direct the liquid upwards against the wall of the tank. The clarified oil flows into a discharge funnel in the upper part of the tank; the funnel is adjustable vertically from outside, and its stem slides in a discharge pipe which extends downwards within the tank and passes out through the side near the bottom. A heating coil is arranged above the surface of the liquid to assist its flow into the discharge funnel.—W. F. F.

Hydrogenation of fats and oils. J. Dewar and A. Liebmann. Fr. Pat. 472,888, June 2, 1914. Under Int. Conv., June 4, 1913.

SEE Eng. Pat. 12,982 of 1913; this J., 1914, 797.

Method for decolorising liquids. U.S. Pat. 1,131,308. *See* I.

Lubricant. U.S. Pat. 1,133,204. *See* IIA.

Washing compounds. Eng. Pat. 19,229. *See* VII.

Viscosimeter. U.S. Pat. 1,132,621. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead specification. Oil, Paint, and Drug Rep., April 12, 1915.

THE U.S. Navy Department issued on March 1st specification No. 52L1b, for white lead, as follows:—*White lead, dry.* The pigment shall be pure hydrated carbonate of lead, free from all adulterants. The total acetate shall not be in excess of the equivalent of 0·15% of absolute acetic acid. *White lead, in oil.* To be of the same quality as white lead dry, and be finely ground in at least 8·50%, by weight, of pure raw linseed oil in accordance with the latest issue of Navy Department specifications for raw linseed oil. The material shall not contain more than 0·50% of moisture. *Comparison with standard sample.* White lead, dry and in oil, shall be free from crystalline structure and be equal in whiteness, fineness, opacity or body, tinting strength, and covering qualities to the standard sample of white lead, samples of which may be obtained by application to the construction officer, navy yard, New York. *Tinting test.* The tinting strength will be compared with the standard sample of dry white lead as follows:—10 grms. of dry white lead will be thoroughly ground with 10 mgrms. of dry lampblack and a sufficient weight of raw linseed oil to reduce the lead to a paste form, and compared with equal amount of standard white lead, dry lampblack, and linseed oil ground in the same manner. When placed alongside the standard sample on a glass slide, the tint of the lead under test shall not be darker than that of the standard sample. In case of samples of white lead in oil, the oil will be extracted with gasoline or some equally suitable solvent, so that the tinting test can be made on the dry pigments.

Chrome yellows and greens; Analysis of ——. A. Given. J. Ind. Eng. Chem., 1915, **7**, 321.

Moisture and lead carbonate. Moisture is determined by drying 1 grm. of the pigment for 4 hours at 105°—110° C. in a small beaker. The residue is mixed well with 50 c.c. of 50% acetic acid, allowed to stand over night, then filtered through a Gooch crucible, and the residue washed, dried, and weighed; the loss in weight is reckoned as lead carbonate. *Lead sulphate and chromate.* 1 grm. of pigment is boiled for 5—10 mins. with 50 c.c. of water and 50 c.c. of 25% caustic soda solution, filtered through a Gooch crucible, the residue (*a*) washed, and the filtrate diluted to 250 c.c. In 50 c.c. of this solution the sulphate is determined by adding excess of hydrochloric acid and 5 c.c. of alcohol, boiling until the chromate is reduced to chromic chloride, and precipitating with barium chloride. In another 50 c.c. the total lead is determined as chromate by adding excess of nitric acid, heating to boiling, and precipitating with 25 c.c. of a boiling saturated solution of potassium chromate. The difference between the total lead and that present as carbonate and sulphate gives the lead as chromate. *Barytes or china clay.* The residue (*a*) (see above) is treated for 10 mins. with hot hydrochloric acid (1 : 1), filtered, and the residue washed. This treatment is repeated twice again, and the final residue is reckoned as barytes or china clay, according to the base of the pigment. —A. S.

Oleoresin of the sand pine. A. W. Schorger. J. Ind. Eng. Chem., 1915, **7**, 321—322.

THE sand pine (*P. clausa*, Sarg.) is practically confined in its range to the State of Florida. Its oleoresin contained 6·1% of water and 2·67% of "trash," and yielded 18·93% of volatile oil and 72·30% of resin (grade G.). The resin had the saponification value 178·7 and acid value 172·5. It consisted mainly of abietic acid, but contained 4% of resene soluble in light petroleum spirit. The volatile oil had sp. gr. 0·8723—0·8725 at 15°/15° C., n_D^{20} = 1·4767—1·4768, and a_D^{20} = −22·49 to −22·80°. It contained about 75% of *l*-β-pinene and 10% each of *l*-α-pinene and *l*-camphene.—A. S.

Toxic jaundice due to tetrachloroethane poisoning. Willcox. *See* XIXB.

PATENTS.

Paint; Manufacture of metallic ——. The British Patent Surbrite Co., and E. G. Meadway, London. Eng. Pat. 7087, March 20, 1914.

METALLIC powder (2 lb.) is incorporated with

320 grains of gum mastic dissolved in 2 fl. oz. of a solution of $2\frac{3}{4}$ oz. of rubber in 160 fl. oz. of naphtha or other solvent, and with 113 fl. oz. of a solution of celluloid in amyl acetate or other solvent, and the paint is thinned with the celluloid solvent (15 fl. oz.).—C. A. M.

Solvents with a basis of furfural. G. Meunier. Fr. Pat. 472,123, Aug. 4, 1913.

FURFURAL is claimed as a solvent for nitrocellulose, particularly for pyroxylin containing 11·5% N, also for celluloid, for gums and resins used in varnishes, and for linseed oil varnish. Mixtures of furfural with one or more of the following substances may also be employed :—ethyl, methyl, or amyl alcohol, acetate, or formate; ketones, oil of turpentine, benzene, toluene, acetic or formic acid. The hardest copals can be gelatinised and to a large extent dissolved without discoloration by digestion with a mixture of equal volumes of oil of turpentine, acetone, and furfural at 40°—50° C., and a mixture of 77 vol. of ethyl alcohol (95° Gay-Lussac) and 23 vols. of furfural can frequently be employed as a substitute for acetone, amyl alcohol, or amyl acetate.—F. SP.

Lacquers from nitrocellulose or resins; Preparation of ——. Chem. Fabr. Buckau, Abteilung Dubois und Kaufmann. Ger. Pat. 280,376, July 31, 1913.

NEUTRAL esters of alkylcarbonic acids are used as solvents.—A. S.

Resinous products; Preparation of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 280,595, Jan. 25, 1913.

COMPOUNDS of the general formula, $R.CH_2.X$, where R is an aromatic residue and X is a halogen, *e.g.*, benzyl chloride or bromide, *o*-chlorobenzyl chloride, or ω-chloro-α- or -β-methylnaphthalene, are treated with metallic halides, *e.g.*, with ferric chloride at the ordinary temperature, or with aluminium chloride or zinc chloride at a higher temperature, in absence of diluents. The resinous products so obtained are soluble in benzene, carbon tetrachloride, and other organic solvents. —A. S.

Resin lacquers. Badische Anilin und Soda Fabrik. Ger. Pat. 280,377, Jan. 25, 1913.

LACQUERS are prepared by dissolving in volatile solvents the resinous products obtained by treating benzyl halides or their derivatives with metallic halides (see preceding abstract) or with metals (Zincke, Ber., 2, 739).—A. S.

Lacquers from cellulose derivatives; Preparation of ——. Zapon-Lack-Ges. Ger. Pat. 281,265, April 22, 1913.

CELLULOSE derivatives are dissolved in the usual solvents, *e.g.*, acetone oil, methyl alcohol, ketones, or the like, in which the polymerisation products of coumarone and indene have been previously dissolved, and the products are diluted with alcohol, petroleum spirit, benzene, or the like.—A.S.

Manufacture of insoluble azo dyestuffs. Fr. Pat. 472,889. *See* IV.

Azo dyestuffs and products used in producing them. Fr. Pat. 472,893. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Isolation of the insoluble constituent of ——. G. Bernstein. Kolloid-Zeits., 1914, **15**, 49—50. Z. angew. Chem., 1915, **28**, Ref., 24.

A TWO per cent. solution of the rubber in petroleum spirit is exposed to ultra-violet light from a Westinghouse lamp, with exclusion of air: complete depolymerisation of the rubber is effected in less than 3 minutes, the viscosity of the solution falling until it is not much greater than that of the solvent, and the liquid can then easily be separated from the insoluble matter by decanting or filtering. —A. S.

Caoutchouc; Regeneration of —— *from its tetrabromide.* F. Kirchhof. Kolloid-Zeits., 1914, **15**, 126—131. Z. angew. Chem., 1915, **28**, Ref., 24—25.

ABOUT one-half of the combined bromine in caoutchouc tetrabromide is removed by heating with alcoholic potash at about 100° C. The remaining bromine is removed completely only at a much higher temperature. The bromine-free product is isomeric, but not identical with normal caoutchouc. It was found, contrary to the statements of Ostromisslensky, that from the tetrabromide from raw rubber an inelastic product is obtained by regeneration with metallic calcium and an elastic product by regeneration with aniline. The author considers that the processes of Ostromisslensky (this J., 1912, 318) and of Harries (this J., 1913, 372; 1914, 93, 269) are not likely to acquire importance technically in the near future on account of their costliness, the inferior value of the products in comparison with those obtained by other regeneration processes, and the low price of raw rubber.—A. S.

PATENTS.

India-rubber; Treatment of fabrics used in conjunction with ——. W. E. Muntz, London. Eng. Pat. 4910, Feb. 26, 1913.

SEE Fr. Pat. 468,493 of 1914; this J., 1914, 974. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2221 of 1867, 8963 of 1885, 11,299 of 1898, and 23,873 of 1910.

India-rubber; Process of reclaiming old or waste vulcanised ——. T. Gare New Brighton. U.S. Pat. 1,133,952, March 30, 1915. Date of appl., Sept. 17, 1906.

SEE Eng. Pat. 19,894 of 1906; this J., 1907, 1288.

Impregnation of fibrous materials and textiles [with rubber solutions]. Fr. Pat. 472,844. *See* VI.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin analysis; High results in ——. H. G. Bennett. Collegium (London), 1915, 97—102.

EXPLANATIONS are advanced for the variations of 1—2% tannin in the results obtained by different chemists for the same materials. Weighing residues once only, except those of tan liquors or when dried for 15—16 hours, is inadmissible. Residues of soluble solids, particularly in the case of quebracho, gambier, myrobalans, or sumach, still lose after the non-tannins have been dried to constant weight, and if they are not dried further, may cause an error corresponding to more than 0·5% tannin. The author recommends the use of well-ventilated ovens at a temperature as near 100° C. as possible for the drying of organic residues. The variation from 0·35 to 0·45% tannin officially allowed in the concentration of infusions for analysis gives rise to errors. If infusions containing as nearly as possible 0·45% tannin are used, the residues are greater and not so easily dried, and the relative absorption by the hide powder is greater. All the above errors give a higher tannin result. Experiments are cited to show that basins should

be allowed to cool for one hour before weighing. The suggested remedies for the above errors are the evaporation of half quantities of infusion in the case of total and soluble solids, a uniform time of not less than one hour for cooling basins, and a narrower range of concentration of tannin infusions.—F. C. T.

Quebracho extract; Suspected adulteration of —— with sulphite-cellulose. H. Becker and J. Gross. Ledertechn. Rundschau, Oct. 22, 1914. Collegium (London), 1915, 106—108.

An extract described as pure quebracho showed about 15% sulphite-cellulose according to the Procter-Hirst reaction, high alcohol figure, low gallic acid value, and high non-tannin content. Other results, particularly the large amount of sulphates in the ash, confirmed this. Becker is of the opinion that quebracho extract might give the above results if made from partly rotten wood, owing to the solution of a larger amount of non-tannin substances. A sample of unsound wood was extracted, and the analytical results indicated 20% sulphite cellulose. Gross points out that only 2% of rotten wood is allowed in commercial quebracho wood, and that attempts to make from quebracho wood alone an extract showing figures like those of Becker's extract, did not succeed. From experience he finds that a quebracho extract, even if prepared under pressure and highly sulphited, cannot be regarded as pure if it contains more than 6% of non-tannins. F. C. T.

Moellon analysis; Report of committee on ——. T. A. Faust. J. Amer. Leather Chem. Assoc., 1915, **10**, 174—178. (See also this J., 1915, 41.)

The method previously proposed for the determination of unsaponifiable matter is quite reliable, if the petroleum ether solution is washed with 25% alcohol. The results in the determination of oxidised fatty acids led to the following revised method:—The soap solution from the determination of unsaponifiable matter is boiled till all the alcohol is expelled, and is then dissolved in hot water. The solution is transferred to a separating funnel, made up to about 300 c.c., and a slight excess of concentrated hydrochloric acid added. A large excess of acid causes low results. The contents of the funnel are vigorously rotated and extracted with petroleum spirit. The aqueous layer is run off, and the petroleum layer poured out, avoiding loss of oxidised acids. These acids are washed twice with small quantities of petroleum spirit and hot water to ensure complete removal of oil and salt. The oxidised acids are then dissolved in warm 95% alcohol, and the solution filtered and evaporated, the evaporation and drying occupying 16 hours. The whole operation should be carried out without delay. —F. C. T.

Sulphite-cellulose in leather; Cinchonine for the detection of ——. W. Appelius. Ledertechn. Rundschau, 1915, 17. J. Amer. Leather Chem. Assoc., 1915, **10**, 202—203. (See also this J., 1915, 189.)

The cinchonine test is uncertain with leather extracts unless carried out according to the following method:—5—10 grms. of leather, cut into small cubes (not finely ground), is extracted by heating to boiling with 100 c.c. of water. After filtration 5 c.c. of 25% hydrochloric acid is added to the filtrate, which is heated to boiling and again filtered; 20 c.c. of cinchonine solution is then added to 50 c.c. of the filtrate, together with a very little tannin solution, and the mixture heated to boiling without moving the flask. A lumpy, brown-black precipitate appears in the presence of even small amounts of sulphite-cellulose.—F. C. T.

Sulphited tanning extracts; Analysis of ——, and determination of free sulphuric acid in leather. L. Dufour. Collegium, 1914, 613—617. Z. angew. Chem., 1915, **28**, Ref., 31.

In the determination of free sulphuric acid by Balland and Maljean's method (this J., 1895, 496) sulphur in organic combination is also determined, and this may lead to serious errors, especially in the case of sulphited extracts. The organic sulphur in catechol-tannins may be determined by precipitating with formaldehyde in presence of hydrochloric acid, incinerating the precipitate after addition of sodium carbonate, dissolving the residue in water acidified with nitric acid, and precipitating with barium chloride. Extracts of sulphite-cellulose or Neradol are precipitated with cinchonine hydrochloride instead of with formaldehyde.

The content of free sulphuric acid in leather tanned with sulphited extracts can be determined more accurately by the method of Procter and Searle (this J., 1901, 287) than by Balland and Maljean's method (*loc. cit.*), especially if incineration is effected without the use of a coal gas flame.—A. S.

Sulphuric acid in leather; Determination of ——. L. Jablonski. Ledertechn. Rundschau, 1914, **6**, 281. Z. angew. Chem., 1915, **28**, Ref., 31.

The leather is boiled with a mixture of glacial acetic acid and a chloro-derivative of acetic acid for 1—3 hours under a reflux condenser, the mixture is diluted with water and filtered, the residue washed, and the sulphuric acid in an aliquot part of the filtrate determined as barium sulphate. The method, in conjunction with an analysis of the ash, allows of the differentiation of free sulphuric acid and sulphates.—A. S.

Corrigendum. This J., April 15th, 1915, p. 368, col. 2, abstract on "Artificial bates." In line 14 of abstract, for "a bate" read "an enzyme bate."

Patents.

Hides and skins; Treatment [depilation] of ——. W. Owen, Warrington. Eng. Pat. 1375, Jan. 28, 1915.

The hides are treated with "soleite" (a mixture of common salt, sodium carbonate, and tannic acid) either dry or in solution, allowed to stand for four days, then hung exposed to the atmosphere for two days, soaked, and subsequently unhaired as usual. A saving of time and complete avoidance of stains on the skins are claimed for this process. —F. C. T.

Skins; Treatment of ——. R. Vidal. First Addition, dated Aug. 21, 1913, to Fr. Pat. 435,017, Sept. 23, 1911 (this J., 1912, 349).

The application of alkali sulphites, thiosulphates, or polysulphides to the skins, described in the chief patent, is best effected in the presence of alkali hydroxide, carbonate, or sulphide. A further drumming with hydrogen peroxide gives the skins still more stretch, and bleaches and brightens the hair. This operation is followed by tannage.—F. C. T.

Leather; Material similar to ——. R. Miller. Fr. Pat. 472,852, May 30, 1914.

Material suitable as a substitute for leather or cardboard, is formed by treating a mixture of vegetable or other fibres and gelatin or glue, with chrome alum, and subjecting to pressure. F. C. T.

Leather; A special —— and process of making it. Soc. Anon. Nouvelle L'Oyonnithe. Fr. Pat. 473,380, Sept. 19, 1913.

A new product called "Norman leather" is made

by compressing a sheet of celluloid (coated with celluloid solution or glue) with a prepared sheet of ordinary leather of any desired thickness, or between two such sheets. The celluloid matches the leather in colour.—F. C. T.

Tanning agents; Process of producing soluble —. E. Dehnel, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,108, March 23, 1915. Date of appl., June 30, 1913.

SEE Eng. Pat. 24,982 of 1912; this J., 1913, 919.

Tanning preparations; Soluble —. Badische Anilin und Soda Fabrik. First Addition, dated Aug. 5, 1913, to Fr. Pat. 461,746, Nov. 5, 1912.

SEE Eng. Pat. 18,259 of 1913; this J., 1914, 877.

XVI.—SOILS; FERTILISERS.

Soils; Variation of the fertility of —— under the influence of natural conditions and dry air storage. K. Ghedroiz. Selskoie Khosiastro i Lessovodstvo, 1914, **47**, 630—633. Bull. Bureau Agric. Intell., 1915, **6**, 37—39.

CULTURES of oats and flax were grown in zinc pots containing soil which had been stored in dry air for periods of 1 to 6 years. Some of the pots were treated with a complete manure, containing calcium nitrate, mono-sodium phosphate, and potassium sulphate; others with the same less the nitrate, phosphate, and potassium sulphate respectively, and there were the usual control pots. A gradual increase was observed in the crops with the length of time the soil had been stored in all cases, except in that of oats with the complete manure, where the greatest yield was obtained with the soil which had been stored for one year. These and other experiments showed that when a soil is stored in dry air, its productivity increases in proportion to the length of storage; the phosphoric acid and nitrogen contents of the plants, and the citric-soluble P_2O_5 of the soil, vary in a like manner.—E. H. T.

Soil; Nitrogen metabolism in the ——. H. H. Green. Centralbl. Bakt., Abt. II., 1914, **41**, 577—608. Bull. Bureau Agric. Intell., 1915, **6**, 39—40.

SAMPLES of soil from field plots manured respectively with sodium nitrate, ammonium sulphate, and blood, flesh, and horn meals, were taken at monthly intervals from Aug. 1912 to Aug. 1913, and were tested as to the ammonification of the nitrogen in the organic fertilisers, the nitrification in the ammonium sulphate, and the fixation of atmospheric nitrogen. The ammonification curve rose from Aug. to Oct., remained level or fell slightly during Nov., rose to a maximum in Dec., fell to a minimum in Feb., and attained a lower maximum in April; thenceforward there was a slight fall until the summer minimum in August was reached. The nitrification curve was similar, except that the spring maximum was in March and the summer decline began in April. The smallness of the actual variations and the unexpected maxima in Dec. were held to be due to the exceptionally mild winter. The seasonal variation is considered to be related to the activity of the soil protozoa. Nitrogen fixation through *Azotobacter* was observed in July and Aug., 1913, though no perceptible growth of these organisms in mannitol solution inoculated with soil had been remarked in any of the preceding ten summers. A comparison of the crop returns with the laboratory tests of the bacterial activity, showed that the latter were a very fair index of the former; but there was no bacteriological evidence to account for the better crops obtained on soil which had been cultivated in autumn compared with those grown on land which was left untouched till spring.—E. H. T.

Nitrogen; Direct assimilation of atmospheric —— by plants. M. Molliard. Comptes rend., 1915, **160**, 310—313. (See also Mameli and Pollacci, this J., 1915, 293.)

RADISHES were cultivated from seed under strictly aseptic conditions in tubes containing powdered pumice impregnated with a solution containing mineral salts, dextrose, and ammonium chloride. After seven weeks, the total nitrogen of the tube-contents was determined and compared with that originally present in the seeds and in the liquid. The gain or loss of nitrogen was in every case less than the experimental error involved. When the plants were grown to their full extent with the roots in the aseptic solution but the stems in the free air, a very slight gain (1·32 mgrm.) of nitrogen was observed, much less than that found by Mameli and Pollacci (7·9 mgrm.). The gain was due to assimilation of combined nitrogen present in the air.—E. H. T.

Chlorides and nitrates of potassium and sodium; Influence of —— on germination [of wheat]. H. Micheels. Intern. Zeits. phys.-chem. Biol., 1914, **1**, 112—119. J. Chem. Soc. 1915, **108**, i., 110.

WHEAT grains previously soaked in water were allowed to germinate in dilute solutions of the chlorides and nitrates of sodium and potassium. The Cl-ion had a more injurious effect than the NO_3-ion, and the Na-ion than the K-ion. The NO_3-ion exerted a beneficial action, especially in relation to the length of the leaves and the weight of the plantlet, and it also caused a lengthening of the root hairs. In presence of Na-ions a longer root appeared to be produced than in presence of K-ions. Similar results were obtained by passing an electric current through the solutions and observing the germination of the grains in the neighbourhood of the cathode and anode respectively.—G. F. M.

Phosphates; Production of available —— by furnace treatment. J. H. Payne. Amer. Fertiliser, 1914, **16**, 41—46. Bull. Bureau Agric. Intell., 1915, **6**, 51—53.

WHEN a mineral phosphate is sufficiently heated in an electric furnace with a non-volatile acid, such as silicic acid, and a reducing agent, such as carbon, the whole of the phosphoric acid is volatilised and may be absorbed in an alkaline liquid. The soluble phosphate produced should contain not less than 30—50% of water-soluble P_2O_5. Plant for carrying out this process has been installed recently near Charlotte, N.C., U.S.A. There are various methods of converting the phosphorus of tricalcium phosphate into a citric-soluble form by calcining with alkaline or acid reagents. That of Wiborgh (Eng. Pat. 2678 of 1896; this J., 1897, 250) consists in heating apatite to a red or yellow heat with from 6—10% of an alkaline sodium or potassium compound, and yields a tetra-calcium sodium or potassium phosphate ($10CaO,2Na_2O,3P_2O_5$), soluble in Wagner's reagent but insoluble in water. In Connor's process (U.S. Pat. 931,846; this J., 1909, 1054) of heating 5 parts of phosphate with 1 pt. NaOH and 2 pts. CaO, a similar product is obtained, and that of Newberry (U.S. Pat. 978,193; this J., 1911, 101) gives the same result with but half the amounts of the alkalis. The calculated cost of production of the Wiborgh product, containing 30% available P_2O_5, will eventually be \$7·13 (about 29s. 8d.) per ton, or 1s. per unit, assuming that the phosphatic

ck contains 70% phosphate and there are no ansport charges.—E. H. T.

ainit: Use of —— in the destruction of weeds. J. Vasters and T. Remy. Landwirt. Jahrb., 1914, **46**, 627—657. Bull. Bureau Agric. Intell., 1915, **6**, 154—156.

INELY ground kainit is very useful for destroying ertain weeds, particularly when they are young. harlock, runch, black bindweed, chickweed, ettle, groundsel, and cornflower are very sensitive o it; redshank and spurrey are moderately usceptible; sowthistle and fumitory only slightly o. The kainit should be distributed uniformly n the plants, in amounts varying from 10—11 cwt. o a maximum of 16 cwt. per acre. The best esults can only be obtained when the weeds are ery wet with dew or rain, and the effect is nhanced if the soil is dry or lightly frozen. Any logging effect upon the surface soil can be rectified vith lime. Cereals stand such a top-dressing of ainit very well, and subsequently benefit from ts application to the soil. Kainit made from arnallite is better than that from sylvine. In he Rhine province the cost of fine grinding is 2½d. per cwt., and that of application 3s. per acre or a dressing of 11 cwt. Although inferior to oeing, kainit is in many respects superior to other weed-killers; it has no permanent injurious ffects when used in large quantities, it is ygroscopic and readily soluble.—E. H. T.

Industrial uses of radium. Baker. *See* VII.

PATENT.

Calcium phosphates; Process of dry concentration of ——. J. Parent. Fr. Pat. 472,709, Aug. 13, 1913.

MINERAL phosphates are calcined at a sufficiently high temperature to eliminate water and organic matter, including bitumen, and to convert practically all the calcium carbonate into calcium oxide, which combines to a slight extent with the silica present to form a silicate not absorbing sulphuric acid. The free lime and other impurities are separated mechanically by fine sieves, the residue constituting the concentrated phosphate.—J. P. O.

XVII.—SUGARS; STARCHES; GUMS.

Bagasse: Rational maceration of —— in the cane sugar factory. L. Pellet. Intern. Sugar J., 1915, 17, 20—26, 74—79, 123—127 and 175—178.

CONTRARY to the opinion generally accepted, the author considers that the maceration water should not be applied just as the bagasse leaves the mill, since then the bagasse adheres to the top roller, diminishing considerably the efficiency of the operation. Preferably the water should be delivered when the bagasse has passed on to the exit platform, which serves as a scraper of the lower rear roller. To effect the maximum sugar extraction and to prevent "swamping," the total water used should be distributed over the bagasse at a number of different points variable with the volume used; preferably it should be sprayed on the bagasse from below as well as from above, and the surface of the bagasse should be renewed frequently by the use of stirrers or overlapping carriers. The modern system of grouping the mill units closely together (so as to be driven by a central engine) has the disadvantage of not permitting the application of the water at a multiplicity of points, which demands considerable distance. In a 4-unit installation with crusher, for example, there should be at least 32—38 ft. between the second and the third units, since it is there the greatest amount of water is delivered. Special atomisers which water the bagasse evenly in a very fine spray should be employed, a number of these being mounted on a horizontal distributing pipe fed from water tanks. Preferably the water used should be that condensed in the evaporators and pans from the exhaust or live steam used for heating these apparatus, and not filter-press washings, nor the water condensed from juice or syrup vapours, and it should be applied at 80°—85° C. under a pressure of about 23 ft., either from a tank or by a pump after careful filtration. In discussing the amount and place of maceration, the author discusses mills of different capacities with and without crushers of the Krajewski type. For example, with a 3-unit installation with a crusher, the amount of water would be about 20% of the weight of cane, one-third being delivered immediately after the first mill, one-third immediately after the second distributor, and the remaining third a few yards after the second mill; while with a 4-unit mill also using a crusher, 20—25% of water and more may be used if applied with four distributors each taking one-quarter, the first immediately after the first mill, the second immediately after the second mill, the third a few yards after the second distributor, and the fourth immediately after the third mill. Steam may be used, replacing water in the last distributor; and the juices from the last mill (which are very weak) may be returned and applied between the first and second mills. To ascertain the amount of water passing into the distributing pipes at any moment, gauges should be used, and it is convenient to unite all these, together with the regulating cocks, on a platform in the centre of the mills, so that the operator may survey the whole process of milling, and especially note what is taking place on the several carriers.—J. P. O.

Sucrose: Determination of —— by double polarisation, employing a new method of clarification. N. Deerr. Intern. Sugar J., 1915, **17**, 179—182.

To eliminate the error caused by the direct reading being taken in an alkaline solution (due to basic lead acetate) and the inversion reading in a strongly acid medium (due to hydrochloric acid), the author takes the two readings in solutions having the same composition so far as non-sugars are concerned. Clarification of both solutions is effected by adding successively baryta and a mixture of aluminium sulphate and sulphuric acid, the small amount of sulphuric acid remaining in solution after the separation of the aluminium hydroxide and barium sulphate being insufficient to induce appreciable hydrolysis while taking the direct reading, but being sufficient to invert all the sucrose present at a high temperature, aided by the hydrolysing action of the excess of aluminium sulphate remaining in solution. The solutions required are: (A) a 0·52 N solution of baryta; (B) a solution of 165 grms. of crystallised aluminium sulphate and 135 c.c. of $N/1$ sulphuric acid per litre; the titre of (B) is adjusted so that 25 c.c. of (A) is equivalent to 15 c.c. of (B). For the direct reading 50 c.c. of the material under examination (containing 3·25 grms. in the case of cane molasses) is mixed with 25 c.c. of (A) and next with 15 c.c. of (B), the volume being completed to 100 c.c., and about 0·4 grm. of sodium hydrosulphite added. After filtering, the solution is polarised, the reading being increased by 0·7% to compensate for the volume of precipitate formed, or the volume may be completed to 100·7 c.c., instead of 100 c.c. For the inversion reading 50 c.c. of the same solution of the material used for the direct reading is treated in a 100 c.c. flask with 15 c.c. of (B), and inversion effected at 95°—97° C. during 20 minutes. After cooling, 25 c.c. of (A) is added, the volume made up to

100 c.c., the liquid filtered, and the saccharimeter reading ascertained, while from the direct and inversion readings is calculated the percentage of sucrose from the usual formula, a special constant, however, being used. This constant varies with dilution and temperature: the following values were found at 26° C.:—Inversion reading (200 mm. tube), —25° V., constant 142·2; —20° V., 141·8; —15° V., 141·3; —10° V., 140·7; —5° V., 139·8; —1° V., 138·4. Advantages of the proposed process, in addition to both readings being made under identical conditions, are that the influence of the lead salts is eliminated, and that the filtrate may be used for the determination of the reducing sugars. On the other hand, in comparison with the ordinary procedure its disadvantages are that the decolorisation is less intense (though reasonably efficient), and that the time required is somewhat greater.—J. P. O.

Sucrose; Oxidation of —— by potassium permanganate. C. W. R. Powell. J. Roy. Soc. New South Wales, 1914, **48**, 223—241. J. Chem. Soc., 1915, **108**, ii. 91—92.

MEASUREMENTS of the rate at which potassium permanganate oxidises sucrose in acid, neutral, and alkaline solution, showed that the velocity of the reaction is least in neutral solution, and that higher oxides of manganese are precipitated during the course of the oxidation unless a certain quantity of acid is present at the beginning. The results obtained in acid solution indicate a bimolecular reaction, although the velocity-coefficient increases during the course of the change: this increase is attributed to the influence of manganese sulphate formed during the reaction. Within certain limits the nature of the reaction does not seem to be affected by the concentration of the acid, but the initial velocity is approximately proportional to the hydrogen-ion concentration. The velocity is increased in the ratio 3 : 1 for a rise of 10° C. Permanganate oxidises dextrose more rapidly than sucrose, but the quantity of the former sugar produced during the time required for the experiments was too small to affect the results.—W. P. S.

Pentoses and hexoses: Mutarotation of the phenylosazones of ——. P. A. Levene and F. B. La Forge. J. Biol. Chem., 1915, **20**, 429—431.

THE initial rotation of an osazone in Neuberg's pyridine-alcohol solution is subject to small variations, dependent on traces of impurities, but the direction of the mutarotation and the equilibrium rotation remain constant. The authors determined the character of the mutarotation of the phenylosazones of the normal pentoses and hexoses with the following results:—

Osazone.	Rotation, $[\alpha]_D$. Soon after preparing solution.	Rotation, $[\alpha]_D$. After 24 hours.	M. pt., ° C.
l-Arabinose	+0·55	+0·30	166
d-Xylose	—0·09	—0·43	164
d-Altrose	—0·40	—0·29	178
d-Gulose	−0·07	−0·40	168
d-Galactose	—0·80	+0·34	201
Dextrose	—0·62	−0·35	208

The determinations were made in a 0·5 dm. tube with D-light, using 0·1 grm. of the substance in 5 c.c. of pyridine-alcohol mixture.—W. P. S.

Temperature coefficient of photochemical reactions. Berthelot. *See* XXIV.

PATENTS.

Cane sugar; Process of refining raw ——. F. Murke, Fort Collins, Colo. U.S. Pat. 1,132,868, March 23, 1915. Date of appl., June 20, 1911.

IMPURITIES adhering to the sugar crystals are removed by mechanical means, *e.g.*, by washing, and a solution of the cleansed crystals is treated at about the boiling point with lime or its equivalent and then recrystallised.—J. F. B.

Liquids [sugar solutions]; Purification [decolorising] of ——. R. H. McKee, Orono, Me. U.S. Pat. 1,133,049, March 23, 1915. Date of appl., March 27, 1912. Renewed Aug. 15, 1914.

LIQUIDS, particularly sugar solutions, are treated with black ash residues, which may previously have been treated with acids or heated to redness. —J. F. B.

Beetroot juice; Rapid and continuous process of cold extraction of —— applicable in sugar factories and distilleries. V. Petrucci. Fr. Pat. 472,598, May 22, 1914.

BEETROOT slices contained between two perforated plates in a series of cylindrical vessels, are treated with a current of cold water passing upwards, which at first displaces pure juice (not a mixture of juice and water), though later the liquid becomes dilute. In this way, using a battery of 7 or 8 vessels, slices may be exhausted rapidly and continuously.—J. P. O.

Starch; Process of extracting —— from manioc and other roots. F. Strumberg. Fr. Pat. 472,772, May 28, 1914.

THE starch is separated from the root fibres by grinding in a mill consisting of two moderately hard stones, the bottom one of which is fixed. —J. P. O.

XVIII.—FERMENTATION INDUSTRIES.

Malt, wort, beer, and yeast; Determination of mineral constituents in ——. F. Schönfeld and S. Sokolowski. Woch. Brau. 1915, **31** [52]. Brewers' J., 1915, **51**, 225—226.

TEN grms. of finely ground barley or malt, or the evaporated residue from 100 c.c. of wort or beer, is carefully charred in a platinum or asbestos crucible and the cake of charcoal is rubbed down and the crucible heated in the direct flame, combustion of the last traces being assisted by treatment with ammonium nitrate. In the case of pressed yeast the sample is passed through a mincing machine, made up into small rolls, one of which is treated for the determination of dry substance and then powdered, 5 grms. of the powder being taken for incineration. Silica is determined in the ash in the usual manner, phosphoric acid by Woy's method; lime and magnesia are determined after precipitation of the phosphoric acid by ferric chloride.

Beer; Study of the foam-keeping capacity of ——. T. Ihnen. Paper read before the Soc. of Graduates, U.S. Brewers' Academy. Brewers' J., 1915, **51**, 221—223.

THE foam-retaining capacity of beer is tested by cooling the sample in bottle to 5° C., pouring the contents into a glass of 500 c.c. capacity and noting the time required for the foam to disappear; good beers will retain the foam for over 30 mins. The foam-retaining qualities are favourably influenced by a high percentage of carbon dioxide; the danger of over-bunging or over-carbonating the bottled beer has been considerably over-rated and

an increase in the quantity of dissolved gas will materially improve the foam-retaining quality, even if the other factors remain unchanged. One of the best samples examined had a foam-retaining capacity of over 30 mins. and contained carbon dioxide 0·59, total proteins 0·27, coagulable proteins 0·01, non-coagulable 0·26, dextrin 2·23, extract 4·15, alcohol 4·07% by weight. This beer, on standing in open bottle for 30 mins., lost 0·06% CO_2 and still had a foam-retaining capacity of over 20 mins. Another beer, originally containing 0·49% CO_2 and 0·37% of total proteins, had almost as good a foam-retaining capacity as the first, but after standing in open bottle for 30 mins., with loss of 0·06% CO_2, the foam-retaining capacity fell to 9½ mins. Thus the view that a high percentage of protein is a necessary condition for good foam-retention is not upheld. The influence of proteins appears to depend rather on the quality of the proteolytic products than on the quantity of total protein. Beers practically identical as regards percentages of carbon dioxide, total protein, and dextrin may be quite different in foam-retaining quality. The percentage of dextrin plays an important part. Although no fixed rule can be laid down, owing to the variable factor of the qualitative value of the proteins, it is generally the case that, under similar conditions as regards carbon dioxide and protein-contents, those beers which are rich in dextrin retain the foam better than those poor in dextrin.—J. F. B.

Rum; Study of the ferments of ——. E. Kayser. Comptes rend., 1915, **160**, 408—411.

The composition of rum depends on the nature of the original sugar solution (molasses) and the method of fermentation and distillation, but principally on the kind of micro-organism used to ferment the sugar. The addition of ammonium sulphate or asparagine to the molasses has a favourable effect on the action of *Schizosaccharomyces*, the quantity of alcohol produced being increased whilst the volatile acids are diminished; the opposite effect is, however, noticed in the case of bottom-fermentation yeast. Yeasts acting in the presence of bacteria isolated from molasses produce, from sterile molasses, about nine times as much volatile acids and less aldehyde than does the yeast acting alone. It is suggested that by the use of selected pure or mixed cultures of yeasts, rums of any desired composition or quality could be prepared.—W. P. S.

Cider vinegar manufacture; Utility of sulphurous acid and pure yeast in ——. W. V. Cruess, J. R. Zion, and A. V. Sifredi. J. Ind. Eng. Chem., 1915, **7**, 324—325.

In the manufacture of cider vinegar in California, the alcoholic fermentation is effected with compressed yeast or is allowed to take place spontaneously. Large quantities of lactic bacteria and *Mycoderma vini* develop, resulting in the loss of alcohol and, frequently, production of an unpleasant flavour. In some small scale tests in barrels, the apple juice was treated with potassium metabisulphite at the rate of 12 oz. per 200 gallons, and after standing for 24 hours was pitched with pure "Burgundy" wine yeast. As compared with natural fermentation this treatment resulted in an increase of 1·8% of alcohol, more complete fermentation of the sugar, elimination of wild yeasts and lactic bacteria, more rapid clearing of both the cider and the vinegar, improved flavour, and more rapid acetification. Analogous results were obtained in large scale tests in which a quantity of metabisulphite equivalent to 8 oz. per 200 gallons was used.—A. S.

Utilisation of volatile waste products of sulphite-cellulose manufacture. Bergström. *See* V.

Terpene substances as by-products of cellulose manufacture. Hellström. *See* V.

Dried yeast as food for farm stock. Crowther. *See* XIXA.

Patents.

Breweries and similar works; Method of heating liquor and the like in ——. H. Boot and R. J. S. Spencer-Phillips, London. Eng. Pat. 6460, Mar. 14, 1914.

In industries where a large supply of hot water is required, the exhaust steam from a steam turbine may be conducted to an injection condenser discharging into the hot water storage tank. The water is circulated by means of a pump from the tank through the condenser, which is also partly supplied with fresh cold water, the amount of which is regulated by a valve automatically controlled by a float in the tank. When the demand for hot water is small, the tank fills up and the cold-water valve is closed by the float; the rise of pressure in the exhaust main then causes the steam to blow directly into the tank through a non-return valve, or through a safety valve into the atmosphere.—J. F. B.

Mash filters; Process for filling —— *with mash of constant and homogeneous composition.* P. Reichardt. Fr. Pat. 473,131, June 6, 1914.

In a mash filter fed by a pump, a return pipe fitted with a valve operated by a hand wheel connects the main pipe carrying the mash to the pump with that conveying it from the latter to the filter. As the resistance of the filter increases in the course of filtration, this valve is opened by degrees and allows some of the mash to return from the pressure to the exhaust side of the pump. The amount of mash supplied to the filter, and the pressure within the latter, can thus be regulated without any throttling of the main mash pipe or any alteration of the speed of the pump. The tendency towards a partial separation of solids from liquid in the pipes is thereby minimised.—J. H. L.

Hops; Apparatus for economising —— *used in the manufacture of ale, beer, stout, and the like.* T. R. Shercliff, Burton-on-Trent. Eng. Pat. 19,380, Sept. 3, 1914.

The apparatus is a modification of that described in Eng. Pat. 18,270 of 1912 (this J., 1913, 804). It is provided with a steam jacket, apertures for pressure gauges and thermometers, an inlet pipe for the wort delivering into the upper part of the funnel-shaped sieve, an overflow pipe, a draw-off tap, and a sluice or watertight door at the bottom for discharging the hops. Around the outlet for the wort the floor is lower than elsewhere and the recess thus formed is covered by a sieve to keep back the hops.—J. H. L.

Carbon dioxide or other gases [fermentation gases]; Apparatus for cooling —— *during the compression thereof.* H. Müry, Zürich, Switzerland. Eng. Pat. 13,530, June 3, 1914. Under Int. Conv., June 4, 1913.

The gas enters the compressing cylinder together with the cooling water, and both pass out directly into a receptacle mounted on the outlet from the cylinder and containing a temperature regulator which controls the feed of the cooling water. The gas and water then pass down an inclined pipe of larger diameter than the receptacle, the lower end terminating in a ball in which separation of the cooling water is completed.—J. F. B.

Yoghourt beer; Manufacture of ——. Versuchs- und Lehranstalt für Brauerei in Berlin. Fr. Pat. 472,483, April 28, 1914. Under Int. Conv., April 30, June 29, July 10, and Dec. 6, 1913.

The following processes are claimed:—Fermenta-

tion of wort by mixtures of yeast and *B. bulgaricus*, the action of the latter being strengthened, if necessary, by employing higher temperatures than usual or by adding fresh cultures during fermentation. Fermentation by yeast alone, and addition of a culture of the bacillus in wort before the secondary fermentation. Acidification of mashes by means of the bacillus, the wort being so drawn off as to carry with it most of the organisms, which remain active during the subsequent fermentation. Fermentation at blood temperature by pure culture yeasts adapted to work thereat, in presence of the bacillus. Addition of small quantities of lactose or albuminoid substances, or both, to Yoghourt beer to prolong the life of the *B. bulgaricus* present.—J. H. L.

Fermented beverages; Treatment of —— with a view to their conservation. A. P. Bouland. Fr. Pat. 472,666, Aug. 12, 1913.

THE secondary fermentation of wines and similar beverages is carried out in a closed vessel capable of withstanding pressure and provided with the usual fittings. The lower part is funnel-shaped and terminates in a valve which communicates with a small chamber closed below by a cock. From time to time the yeast which has subsided is allowed to fall into the lower chamber and afterwards drawn off, in order to obviate its deleterious influence on the bouquet of the wine. —J. H. L.

Hops: Process and apparatus for the production of extracts of ——. L. A. von Horst. Fr. Pat. 473,409, June 12, 1914. Under Int. Conv., Oct. 31, 1913.

SEE Eng. Pat. 24,813 of 1913; this J., 1914, 659.

Beer or other liquids; Process and apparatus for the clarification of ——. E. R. Curtis and J. W. Huxley. Fr. Pat. 473,335, June 11, 1914. Under Int. Conv., June 12, 1913.

SEE Eng. Pat. 13,619 of 1913; this J., 1914, 707.

Utilising the fermentable and reducing carbohydrates in sulphite-cellulose waste lyes for obtaining alcohol or a reducing agent. Addition to Fr. Pat. 456,871. *See* V.

XIXA.—FOODS.

Wheat; The organic phosphoric acid of ——. G. Clarke. Chem. Soc. Trans., 1915, **107**, 360.

BY extracting ground wheat with 0·2% hydrochloric acid and treating the pale brown extract as described for the preparation of phytin from mustard (see this J., 1914, 436), a white amorphous substance was obtained which resembled phytin in its properties; the yield was 0·14%. The substance thus obtained was a mixture of complex calcium and magnesium salts of the type, $C_{12}H_{22}O_{44}P_{10}Ca_7Mg$. When heated under pressure at 130° C. with 30% sulphuric acid it was decomposed into inositol, m.pt. 211°—212° C., and phosphoric acid. Its composition differed from that of the calcium magnesium salt extracted from mustard (*loc. cit.*). The free acid, obtained from the calcium magnesium salt described above by preparing the lead salt and decomposing the latter with hydrogen sulphide, consisted of a mixture of phosphoric acid in organic combination and phosphoric acid. The strychnine salt of the former acid was sparingly soluble in water, from which it crystallised in needles, m.pt. 218°—219° C.; the strychnine salt of the inositol-phosphoric acid obtained from phytin extracted from mustard melted at 203°—204° C.—W. P. S.

Sulphates in flour; Determination of ——. G. D. Elsdon. Analyst, 1915, **40**, 142—143.

TEN grms. of the flour is heated gently with 25 c.c. of hydrochloric acid, with frequent shaking, until the liquid is deep purple, and the beaker is then left on the cover of the water-bath for about an hour. The liquid is diluted with about 100 c.c. of water and filtered, the filter washed once with cold water, the filtrate and washings heated to boiling, and the sulphuric acid precipitated with barium chloride. The average amount of SO_3 thus found in samples of plain and self-raising flour was 0·012%. In determining the sulphate in phosphatic self-raising flour an allowance of 0·025% of calcium sulphate (the maximum amount likely to be present normally in the flour) should be made.—C. A. M.

Milks; Capillary behaviour of ——. E. Lenk. Die Naturwissenschaften, 1914, **2**, 813—816. Bull. Bureau Agric. Intell., 1915, **6**, 140—142.

KREIDL and Lenk found that if drops of milk fall upon thick blotting paper with a high content of mineral matter, three concentric rings are formed. The inner circle contains the fat, the middle ring contains the casein, the outer ring the water and dissolved matter. The two inner rings remain visible for hours but the outer one gradually becomes indistinct. The casein and water contents of milk can be estimated roughly by observing the sharpness of the boundary of the two outer rings—the more water the less clear the delimitation—and their ratio to each other. The milk of animals, *e.g.*, goats, mares, rabbits and rats, which resembles cow's milk when examined with the ultramicroscope, gives the three-ring formation, but the middle ring is lacking if the casein be coagulated, or if the fat content be high (up to 30%). Human milk gives only two rings because its casein is in solution, not being visible with the ultramicroscope. As the rate of diffusion of a drop of milk on absorbent paper depends chiefly upon the amount of fat, the latter can be determined quantitatively from the former. The rates of diffusion for milk with 10% fat, for whole milk, for milk watered at 50%, and for skimmed milk are, respectively, 0·47, 0·71, 1·22, 2·36 inches per minute. The milk of various mammals has been studied with reference to the height to which it ascends by capillarity in strips of filter paper. The differences observed are due to the different concentration of casein. Watered and skimmed milk both rise higher than pure milk, but no reliable inference can be drawn that any given sample has been tampered with. —E. H. T.

Lactose in milk; Use of colloidal iron [hydroxide] in the determination of ——. R. L. Hill. J. Biol. Chem., 1915, **20**, 175—177.

A TEN per cent. solution of colloidal iron (dialysed ferric hydroxide) may be used for precipitating proteins from milk previous to the determination of the lactose. Ten grms. of the milk is diluted with water to 25 c.c., and about 3 c.c. of the solution of colloidal iron hydroxide is added; the actual quantity of the latter required depends on the composition of the milk and can be ascertained by adding the last portion drop by drop. When too little has been added, the mixture remains turbid, but when precipitation is complete a clear supernatant liquid separates from the flocculent precipitate; the liquid will have a reddish tinge if too much iron has been added. The mixture is filtered, the precipitate washed with water, the filtrate diluted to 100 c.c., and the lactose determined by titration with Benedict's solution (see this J., 1911, 439).—W. P. S.

Boric acid in butter; Routine detection and determination of ——. H. Hawley. Analyst, 1915, 40, 150—152.

TWENTY grms. of each sample of butter is melted, the aqueous layers stirred with 18 c.c. of dilute hydrochloric acid (20 c.c. per litre), and 10 c.c. of fat-free liquid pipetted from each beaker. After cooling, 5 c.c. of turmeric reagent is added to each. This is prepared by digesting 5 grms. of turmeric root and 5 grms. of tartaric acid with three successive portions of alcohol or methylated spirit for not less than an hour each time, and diluting the extract to 500 c.c. with alcohol. It should be kept in the dark. The colours obtained in the tests are compared with those given by standard dilute hydrochloric acid solutions containing 0·1 to 0·5% of boric acid and 0·5 c.c. of milk to match the opalescence of the samples. The results are accurate within 0·1%. Samples containing above 0·5% of boric acid should be analysed by the usual method of extraction and titration.—C. A. M.

Yeast; Dried —— as food for farm stock. C. Crowther. J. Board Agric., 1915, 22, 1—10.

DRIED brewers' yeast is extensively employed in Germany for cattle-feeding, and there are now in England several drying plants producing 2000—3000 tons annually, mainly for export. Its average composition is:—moisture 4·3%, proteins 48·5%, oil 0·5%, fibre 0·5%, ash 10·7%, soluble carbohydrates (by difference) 35·5%. Even when mixed with other foods and water, it may be kept for several days without objectionable fermentation taking place. Feeding experiments in Yorkshire showed it to be a safe food for cows, calves, and pigs, though cows show an aversion to it on account of its bitter flavour. When given to pigs it produced better results than "sharps," weight for weight, used as a partial substitute for the latter.—J. H. L.

Colorimetric determination of a-amino-acid nitrogen. Harding and MacLean. *See* XXIII.

PATENTS.

Milk and cream; Process of sterilising ——. A. Rutter, Mentone, Australia. Eng. Pat. 216, Jan. 3, 1914. Under Int. Conv., May 29, 1913.

MILK or cream is treated with from 0·05 to 0·15% of its weight of an alkali peroxide, *e.g.*, sodium peroxide, a quantity of citric acid sufficient to neutralise the alkalinity due to the peroxide is added, and the whole is then heated to 30°—52° C. for 30 minutes or more.—W. P. S.

Foods with a lecithin basis; Preparation of ——. A. Szücs, and F. Neumann's Nachfolger. Fr. Pat. 472,826, May 30, 1914. Under Int. Conv., June 23, 1913.

FINELY powdered lecithin is emulsified with a small quantity of milk, and the emulsion is added to milk for immediate consumption or to sterilised milk for the manufacture of cheese or other dairy products.—J. H. J.

Milk; Production of a nutritive beverage from skimmed ——. R. Eichloff. Ger. Pat. 280,446, June 14, 1913.

THE milk is heated with an acid, *e.g.*, hydrochloric acid, to sterilise it and invert the lactose, and is then submitted to the simultaneous action of peptonising enzymes and fermentation organisms, for example trypsin and yeast. The fermented liquid is sterilised by heat, filtered, and evaporated to the desired consistence.—A. S.

Fruit juice from the residuum of the manufacture of cider or of perry and process for preparing the same. A. Cordier, Paris. Eng. Pat. 20,143, Sept. 24, 1914. Under Int. Conv., June 27, 1914.

THE pressed residue of fruit pulp obtained in the manufacture of cider or perry is boiled with water and the aqueous extract is evaporated to dryness. The dry product is dissolved in water for use as a flavouring material.—W. P. S.

Pectic substances for confectionery; Extraction of ——. H. A. Deroy and J. Rennotte. Fr. Pat. 473,316, May 9, 1914.

PECTIC substances are extracted from fruits or vegetables by hot lixiviation and maceration, and the extract is concentrated in air or *in vacuo.* —J. H. J.

Coffee substitutes; Method of manufacturing —— J. H. Kellogg, Battle Creek, Mich. U.S. Pat. 1,133,037, March 23, 1915. Date of appl., May 12, 1913.

A MOIST mixture including sugar-containing materials, is heated under pressure until the sugar is caramelised, and the insoluble substances are then removed.—W. P. S.

Desiccating [liquids]; Method of ——. I. S. Merrell, Syracuse, N.Y. U.S. Pat. 1,133,051, March 23, 1915. Date of appl., Dec. 8, 1913.

LIQUIDS containing organic substances are sprayed into a chamber in which a very low pressure is maintained; superheated steam is also introduced into the chamber, which is surrounded by a heating jacket to prevent condensation.—W. P. S.

Cocoa and chocolate pastes; Roasting of ——. F. E. F. Neumann. Fr. Pat. 472,834, May 30, 1914.

THE paste is spread out in a thin layer and left for a short time upon flat moving surfaces of metal or porcelain heated to the roasting temperature.—J. H. J.

Milk; Centrifugal clarification of ——. B. R. Wright, Poughkeepsie, N.Y., U.S.A. Eng. Pat. 7814, March 27, 1914. Under Int. Conv., July 21, 1913.

SEE U.S. Pat. 1,122,457 of 1914; this J., 1915, 196. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 323 of 1913.

Milk; Preparation of an alimentary product from ——. R. Eichloff. Fr. Pat. 473,439, June 13, 1914. Under Int. Conv., June 13, 1913.

SEE Ger. Pat. 280,446 of 1913; preceding.

Foodstuff; Manufacture of an easily digestible —— from whole wheat grains. C. Mauterer. Fr. Pat. 472,790, Aug. 19, 1913.

SEE Eng. Pat. 18,837 of 1913; this J., 1914, 803

XIXB.—WATER PURIFICATION; SANITATION.

Sewage; Treating and disposing of ——. Roy. Com. on Sewage Disposal. Final Rept., Feb. 11, 1915. [Cd. 7821.]

THIS report is a general summary of the conclusions and recommendations contained in the nine reports already issued. Of these reports, four dealt mainly with the purification of domestic sewage discharging into streams, two with the discharge of sewage into tidal waters, and three with the discharge of manufacturing effluents. Following on the recommendations of the Commission, shell fish owners agreed to close sewage-polluted layings, and oysters

are in consequence far safer articles of diet now than formerly. As the result of the Commission's experimental work, a plant was erected for the purification of distillery waste, which has proved capable of producing at a reasonable cost an effluent which is not injurious to fish; other similar plants are in process of erection.

The ninth and latest report dealt with two subjects, the discharge of manufacturing wastes which cannot be taken into sewers, and the disposal of domestic refuse in rural areas. Manufacturing wastes can be divided into two classes, those for which efficient purification is practicable, and those for which it is not. In certain cases in the first class, adequate reduction of the solids in suspension by settlement may be regarded as efficient purification. In coal washing and in paper mills, the effluents should not contain more than 4 parts per 100,000 of suspended solids. In tin, lead, and zinc mines, china clay works, and stone quarries, a standard of 6 parts of suspended solids is suggested provisionally. This should obviate danger to cattle or fish from poisoning by lead, tin, antimony, or arsenic. In other cases, a reduction of dissolved solids as well as suspended solids is necessary. For breweries and maltings, shale oil distillation, tanneries, fellmongers' waste, and dairies, the suspended solids should not exceed 4 parts and the amount of dissolved oxygen absorbed in five days should not exceed 4 parts. For distilleries the standard should be 3 parts suspended solids and 2 parts dissolved oxygen; for woolscouring, tin plating, and galvanising, 6 parts suspended solids, no standard for dissolved solids being fixed at present. In the second class of wastes, in which efficient purification is not practicable, there are certain cases in which clarification would effect considerable improvement, and a standard of 6 parts suspended solids should be attainable for bleach works, paper works, and cotton printing effluents, and a standard of 4 parts for cotton and woollen dyeing effluents. For sulphite cellulose liquors and gas liquors no standards are suggested, but in neither case should the crude waste be turned into a stream. Certain alterations in the existing law with regard to rivers boards and the pollution of streams are recommended.

On the subject of disposal in rural areas, the Commission says that the water carriage system of sewerage is the most satisfactory provided an abundant water supply is available. Where the water supply is inadequate, dry earth closets are open to little objection, the domestic waste water being distributed over gardens or conveyed to cesspools.—J. H. J.

Sewage; Purification of —— by aeration in the presence of activated sludge. E. Bartow and F. W. Mohlman. J. Ind. Eng. Chem., 1915, **7**, 318—320.

EXPERIMENTS were made with a fairly strong domestic sewage free from trade wastes on the lines described by Ardern and Lockett (this J., 1914, 523, 1122). The sewage was placed in a tank, 9 ins. square and 5 ft. deep, having a porous plate 4 ins. above the bottom, and compressed air was introduced below the porous plate. Complete nitrification was effected in 15 days with the use of 4830 cb. ft. of air: the "free ammonia" was first converted almost quantitatively into nitrite, and then the nitrite almost quantitatively into nitrate. The supernatant liquid was siphoned off, a fresh charge of sewage introduced, and the treatment repeated in presence of the residual sludge. In the second treatment nitrification was complete in 4 days with 1270 cb. ft. of air; in the third in 2 days with 720 cb. ft.; in the twelfth in less than 8 hours with less than 128 cb. ft., and in the thirty-first, with sludge and sewage in the proportion of 1 : 5, in less than 5 hours with 35 cb. ft. of air, equivalent to 0·2 cb. ft. per sq. ft. of surface area per minute, or about 3 cb. ft. per gallon of sewage. In presence of the activated sludge nitrate was formed simultaneously with nitrite. The activated sludge contained many *Vorticella* and *Rotifera*, but the predominant organism was an annelid worm, *Aeolosoma hemprichi*, 2—5 mm. long, which multiplies rapidly by fission, and feeds on small organic particles, destroying at least its own weight of organic matter and probably more every day. The sludge lost 95·54% of its weight when dried on the water-bath and then for 3 hours in an oven at 100° C.; the residue contained 6·3% nitrogen, 4% fat, and 1·41% phosphorus, and the loss on ignition was 75%. In pot cultures the dried sludge gave better results as a fertiliser than a quantity of dried blood containing the same amount of nitrogen.—A. S.

Bacteria; Behaviour of —— towards purified animal and vegetable proteins. J. A. Sperry and L. F. Rettger. J. Biol. Chem., 1915, **20**, 445—459.

AEROBES and facultative anaerobes, and even extremely active putrefactive anaerobes, were found to be incapable of attacking and decomposing pure proteins. Solutions of the proteins, however, were decomposed when they contained peptone or other nitrogenous food which furnished the nitrogen necessary for bacterial development. In such cases, the proteolysis of the protein resulted from the action of an enzyme produced by the bacteria during the process of rapid multiplication.—W. P. S.

Tetrachloro-ethane poisoning; Toxic jaundice due to ——. W. H. Willcox. Lancet, 1915, **188**, 544—547.

CELLULOSE varnish, consisting of a solution of cellulose acetate in a mixture of benzene, acetone, methylated spirit, and tetrachloro-ethane, is used in aeroplane factories to coat the calico stretched over the framework of the wings of the machines. The vapour evolved during evaporation of the varnish has a specific gravity of 1·91. Workers using the varnish in several factories were affected with acute jaundice, some cases ending fatally. The symptoms were drowsiness, sickness, jaundice, and mental confusion, sometimes leading to coma and death. Autopsies showed that the most marked change in the organs was the shrunken and bile-stained liver. Experiments on animals, made with the varnish and its volatile constituents, showed that tetrachloro-ethane is a powerful liver poison, and that the poisonous effects of the varnish vapour were due to the tetrachloro-ethane contained in it. In works where the varnish is used, the heavy vapours should be removed by powerful extraction fans placed at a low level. —J. H. J.

PATENTS.

Liquids; Sterilisation, filtration, and similar treatment of ——. L. Linden, Brussels. Eng. Pat. 6855, March 18, 1914.

THE liquid is passed successively, from a main settling tank, through a settling tank, a filter chamber filled with spherical iron, terra-cotta, or marble balls, a chamber divided by a vertical partition and having a horizontal screen near the top, and a second filter chamber filled with spongy iron. It is collected in one compartment of a chamber divided into two parts by a vertical partition reaching nearly to the top, and having discharge openings at the top. The second compartment serves to collect the liquid from a series of settling and filter chambers similar to the first series. The filters in either series may be cleansed by closing the outlets in the central chamber and opening a cock at the bottom of one of the settling

tanks, whereupon the filtered liquid flows through the series in the reverse direction.—W. P. S.

Ultra-violet rays produced by electric sparks, and used for sterilisation; Reflector for ——. J. von Kowalski. Fr. Pat. 473,030, June 4, 1914. Under Int. Conv., May 26, 1914.

The source of light is placed in the focus of the reflector, which consists of one or more hollow mirrors of glazed porcelain, placed above the light so as to reflect all the energy on to the liquid to be sterilised.—J. H. J.

Ozonisers, and sterilisation of water by ozone. H. Gruner. Fr. Pat. 473,184, Sept. 9, 1913.

The ozoniser consists of a number of glass tubes, containing metallic threads, arranged concentrically within a glass cylinder, around the outside of which a metallic spiral is wound. The inner threads are connected to a source of high-tension current and the outer spiral to earth. At the top and bottom are an inlet and an exit for air. In using the ozoniser as a water steriliser, the exit tube is connected to the side tube of a water pump, containing a mixing chamber for securing intimate mixing of the current of ozonised air and water, which then flows to a sterilising chamber of such shape that intimate and prolonged contact between the water and the ozonised air is obtained.—J. H. J.

Sterilising water; Method of ——. M. Riegel. Ger. Pat. 280,998, Oct. 28, 1913.

Sterilisation is effected by treating the water, at the ordinary temperature or at 40° C., with a small quantity of hydrochloric acid and of hydrogen peroxide. The excess of free acid is subsequently neutralised.—A. S.

Water; Purification of [removing dissolved oxygen from] —— to render it suitable for technical application. R. von Walther. Fr. Pat. 473,092, June 5, 1914.

The water is passed through shallow beds of an easily oxidisable metal, such as manganese, zinc, aluminium, copper, or especially iron, which removes the dissolved oxygen quickly and completely. After treatment the precipitated oxides are removed by filtration.—J. H. J.

Naphthenic acids, their soaps, and solutions; Application of —— as insecticides, and process of making the solutions. Soc. La Littorale. Fr. Pat. 472,561, May 22, 1914.

The alkaline liquor resulting from the purification of crude petroleum is treated with 10% by weight of quinoline, and the layer of quinoline saturated with naphthenates is separated by decantation or centrifuging; or the naphthenic acids or naphthenates obtained by neutralising with sulphuric acid the alkaline liquor from the purification of crude petroleum, are mixed with an equal weight of quinoline, separation being effected as before. The resulting solution of naphthenic acids or naphthenates in quinoline may be used as an insecticide, either alone or mixed with a copper or other preparation.—J. P. O.

Nutrient medium for pure cultures of tissues. R. Odier. Ger. Pat. 280,462, May 21, 1913.

Claim is made for nutrient media containing glycogen, which promotes the activity and development of the cells. Specially good results are said to be obtained with a solution containing 8·25 grms. of sea salt, 0·2 grm. each of sodium bicarbonate, potassium chloride, and calcium chloride, and 0·75 grm. of dextrose to 1 litre of water, and saturated with glycogen.—A. S.

Waste water; Process for manufacturing a substance for purifying —— and for draining sludge. F. Richter, Frankfort, Germany. U.S. Pat. 1,133,446, March 30, 1915. Date of appl., June 3, 1912.

See Fr. Pat. 443,789 of 1912; this J., 1912, 1005.

Pumps [for sewage, etc.]. Eng. Pat. 4950. *See* I.

Manufacture of substances capable of exchanging their bases. Fr. Pat. 472,533. *See* VII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids of the morphine series; Action of acetic anhydride on ——. M. Tiffeneau. Bull. Soc. Chim., 1915, **17**, 67—77.

The extra-phenanthrene chain, $CH_2.CH_2.N(CH_3)$, of alkaloids of the morphine group may be attacked by acetic anhydride with rupture, at both ends, of the carbon and the nitrogen bonds or, at one end, of the nitrogen bond only. The two types of rupture are independent of each other, and the latter type has been studied in the case of benzylamine derivatives of simple constitution. To determine rupture of the chain at the nitrogen bond, the nitrogen atom must be tertiary and must be united to a benzene nucleus by an intermediate carbon atom (benzyl type). The alkaloids of the morphine group vary in their behaviour on treatment with acetic anhydride; this variation depends on the character of the nucleus III of the phenanthrene structure. When this is a true aromatic ring, as in the case of morphothebaine, apocodeine, or apomorphine and its derivatives (see Pschorr's formula, this J., 1907, 634), the conditions mentioned above are exactly fulfilled, carbon atom 9 being the connecting link characterising the benzylamine type; in such cases acetic anhydride always causes rupture. When the ring III is of tetrahydro-aromatic type, rupture is never produced by the action of acetic anhydride alone; either there is no reaction (*e.g.*, phenyldihydrothebaine) or simple acetylation without rupture takes place (*e.g.*, morphine and its derivatives, codeine and the bainone). When the ring is of dihydro-aromatic type (*e.g.*, thebaine) or is capable of becoming so by enolisation (*e.g.*, codeinone and pseudocodeinone) the aromatic character may predominate and a double rupture at both nitrogen and carbon bonds may be produced. In these cases, however, the dihydro-aromatic ring is not in itself sufficient to determine rupture and the additional presence of the neutral oxygen (oxide) linkage between carbon atoms 4 and 5 appears to be necessary. As regards the mechanism of the reaction, the acetic anhydride apparently combines first with the trivalent nitrogen, and the instability of the quinquevalent system determines the rupture. The two stages can be sharply differentiated in the case of thebaine by following the reaction with the polarimeter, and the fact that if the tertiary base be previously converted into the corresponding quaternary methiodide, no rupture takes place, affords an additional support to the hypothesis.
—J. F. B.

Alkaloids; Colloidal state of ——. Relations between surface tension, size of particle, and toxicity. I. Traube and N. Onodera. Intern. Zeits. phys.-chem. Biol., 1914, **1**, 35—59. J. Chem. Soc., 1915, **108**, i, 105. (See also this J., 1912, 839.)

Alkaloids such as atropine and quinine, the molecular weight of which exceeds a definite limit, are present in solution in a colloidal state, whilst the corresponding salts form true solutions. The

surface tension of water is hardly affected when alkaloidal salts are dissolved in it, but is diminished on adding subsequently a small quantity of alkali owing to liberation of free alkaloid which assumes a colloidal condition; at the same time the toxicity of the solution increases. Many free alkaloids are unstable in solution, the small particles aggregating in a few hours into large masses, with consequent increase of surface tension and decrease of toxicity. On adding a little alkali to such an attenuated alkaloid solution the aggregates disperse, the surface tension diminishes, and the toxicity reaches or even surpasses its former intensity. The localisation of action of the various alkaloids may be partly due to the variation in the alkalinity of the different organs of the body. The toxicity of solutions of some alkaloids, including quinine, is increased by boiling and subsequently cooling, with corresponding alterations in the size of the colloidal particles and the surface tension. The antagonistic action of pilocarpine on atropine is accompanied by similar changes. With all alkaloids the alteration in surface tension is the chief factor in determining the toxicity. It is suggested that any alteration in the surface tension disturbs the equilibrium or affects the normal velocity of the reactions taking place in the organism, this becoming apparent as a toxic effect, the toxicity of alkaloids being thus due chiefly to the physical instead of to the chemical changes produced. When an electric current is passed through a solution of an alkaloid, the smaller particles wander towards the cathode, whilst the larger aggregates accumulate at the anode.—T. C.

Drugs and poisons; Synergism and antagonism of ——. I. Traube and N. Onodera. Intern. Zeits. phys.-chem. Biol., 1914, **1**, 133—147. J. Chem. Soc., 1915, **108**, i, 105—106.

IF an alkaloid is added to the solution of the salt of another alkaloid, the extent of alteration of the surface tension depends on the relative basicity of the two alkaloids. The relative toxicity of some alkaloids is given by the following descending series of basicities: nicotine, pilocarpine, atropine, physostigmine, quinine, aconitine, veratrine. The surface tension of quinine solutions is increased by the addition of atropine, aconitine, veratrine, and nicotine. The synergetic or antagonistic influence of two substances (drugs, narcotics, etc.) on each other in the body may be due to an indirect action on the velocity of the protoplasmic reactions instead of to the direct action on the surface tension.—T. C.

Alkaloids; Catalytic action of —— *on precipitation, oxidation and saponification processes.* I. Traube and N. Onodera. Inter. Zeits. phys.-chem. Biol., 1914, **1**, 148—157. J. Chem. Soc., 1915, **108**, ii, 92.

ALKALOIDS, although univalent, greatly accelerate the precipitation of arsenious sulphide from its colloidal solution and also the oxidation of oxalic acid by permanganate. A few alkaloids inhibit the saponification of ethyl acetate by potassium hydroxide, whilst the majority accelerate it. Pilocarpine has a strong accelerating action, whilst atropine has an inhibitory action on the saponification process, though both alkaloids act similarly with respect to precipitation and oxidation processes. It is suggested that the antagonistic physiological action of these two alkaloids is possibly correlated with their action on hydrolytic processes.—T. C.

Hydroxymethylanthraquinones; Separation and identification of —— *[in chrysarobin, buckthorn, rhubarb, senna, and aloes].* E. M. Bailey. Amer. J. Pharm., 1915, **87**, 148—151. (See also this J., 1914, 501, 1071.)

THE fluid extract of the drug (25 grms.) is evaporated to remove alcohol, diluted with water, precipitated with a solution of normal lead acetate, the precipitate digested with 10% sulphuric acid on the water-bath, and the hot acid solution extracted with hot benzene. In the case of powdered drugs 3 grms. is boiled for one hour with alcoholic potash, the alcohol removed, the residue treated with dilute sulphuric acid, and the acid liquid extracted with hot benzene. On shaking the benzene solution with 5% ammonium carbonate solution, followed by 5% sodium carbonate solution and by 5% sodium hydroxide, there are extracted successively an unidentified hydroxymethylanthraquinone or mixture of hydroxymethylanthraquinones (in the case of senna and aloes only), emodin, and chrysophanic acid. These substances give characteristic colour reactions when a trace is added to 4 or 5 drops of concentrated sulphuric acid, and a further colour change when 1 to 2 drops of concentrated nitric acid followed by 1 c.c. of water are added. The unidentified substance gives a purple or violet colour with sulphuric acid, becoming yellow with nitric acid and water; emodin gives a pink colour not affected by nitric acid and water, whilst chrysophanic acid gives an orange-red colour with sulphuric acid, becoming yellow with nitric acid and water with simultaneous precipitation of chrysophanic acid. The emodin obtained from both Socotrine and Barbados aloes gave anomalous colour reactions.—T. C.

Anæsthetics; Residual valency of ——, *and its importance in anæsthesia. Chemical theory of anæsthesia.* A. P. Mathews. Intern. Zeits. phys. chem. Biol., 1914, **1**, 433—449. J. Chem. Soc. 1915, **108**, i, 106.

THE average amount of residual valency per molecule possessed by various anæsthetics was computed from the cohesion, and a general, but not complete parallelism was found to exist between anæsthetic power and amount of residual valency. Lack of complete parallelism may be due to the fact that the spacial relation of the valencies must also be an important determining factor. The theory of anæsthesia put forward is that the irritable substance in protoplasm is a molecular oxygen-protoplasmic union or a peroxide union which, on stimulation, passes by molecular rearrangement into a stable form, oxidation taking place and carbon dioxide being produced. Anæsthesia is produced by the anæsthetic, by virtue of its residual valency, occupying the oxygen receptors of the cell, forming a non-irritable, dissociable, anæsthetic-protoplasm compound.—G. F. M.

Phospholipins; Method for the determination of certain groups in ——. M. L. Foster. J. Biol. Chem., 1915, **20**, 403—412.

IT was found possible, by a modification of the Herzig and Meyer method (heating with ammonium iodide and hydriodic acid; see this J., 1895, 688), to obtain a sharp separation of the glycerol and alkyl groups in certain phospholipins (lecithin and cephalin), the former group reacting at 112° C. and the latter at 180°—190° C. A paraffin bath was used for controlling the temperature. Whilst the glycerol could be determined accurately, the separation of the methyl and ethyl groups was not so satisfactory. One preparation of lecithin showed the three methyl groups commonly attributed to this substance, but others showed less; methyl and ethyl groups were not found to be present in cephalin. Experiments with synthetic choline chloride showed that hydriodic acid does not split off the methyl groups completely.—W. P. S.

Glycerophosphoric acid of lecithin; Constitution of the ——. O. Bailly. Comptes rend., 1915, **160**, 395—398.

CALCIUM glycerophosphate, prepared from egg-lecithin by alkaline hydrolysis, has a solubility in water (2·88% at 12·5° C.) intermediate between that of calcium β-glycerophosphate (1·78%) and calcium α-glycerophosphate (4·5%). When the calcium salt is converted into the sodium salt and the latter crystallised, the mother liquor gives the characteristic reaction of the α-salt, viz., formation of dihydroxyacetone-phosphoric acid when oxidised by bromine, but the crystals do not. Further, when the calcium salt itself is crystallised from water, the crystals do not yield dihydroxy-acetone-phosphoric acid, although this may be obtained from the original calcium salt. It is concluded that egg-lecithin consists of a mixture of at least two isomerides of glycerophosphoric acid; the β-compound predominates. (See also this J., 1914, 665.)—W. P. S.

Kaempferia Ethelæ; Volatile oil from tubers of ——. E. Goulding and O. D. Roberts. Chem. Soc. Trans., 1915, **107**, 314—319.

TUBERS of *Kaempferia Ethelæ*, J. M. Wood, ("Sherungulu" tubers) from the Transvaal, containing 25% of moisture, when distilled in steam yielded 1·5% of volatile oil having approximately the following composition: terpenes, including dipentene and probably pinene, 21·8%; cineol, 17·2%; a new ketone, $C_{24}H_{28}O_4$, m. pt. 102° C., $[\alpha]_D$ = +198° 20′ in chloroform, 13%; alcohols, including linalool, 11·2%; esters, chiefly or entirely methylanthranilic acid methyl ester, 1·3%; phenols, 0·5%; acids, chiefly or entirely acetic acid, 0·1%; residue, probably chiefly sesquiterpenes, 34·9%. 93% of the oil consisted of a light oil of sp. gr. 0·9437 at 15° C.; α_D in 100 mm. tube = +19° 17′; acid value, 2·3; ester value, 5·0; ester value after acetylation, 47·6; whilst the remaining 7% formed a heavy, dark brown, viscous liquid, with an odour resembling crushed ivy leaves, which gradually became semi-solid owing to separation of the ketone of m. pt. 102° C. The ketone gave a hydroxylamino-oxime of m. pt. 184° C., an oxime, m. pt. 166°, and a benzoyl derivative, m. pt. above 260° C.—T. C.

Acidity [in physiological fluids]; Determination of ——. I. Traube and R. Somogyi. Intern. Zeits. phys.-chem. Biol., 1914, **1**, 479—484. J. Chem. Soc., 1915, **108**, ii, 101—102.

FIVE c.c. of a 2% solution of sodium isovalerate, a capillary-inactive salt, is mixed with 0·2 c.c. of serum or other tissue fluid, and the lowering of surface tension due to the liberation of the capillary-active isovaleric acid by the free acid present in the liquid under examination is measured by the viscostagonometer at 23° C.—T. C.

Salicylic acid; A new colour reaction of ——. P. A. W. Self. Pharm. J., 1915, **94**, 521.

WHEN a trace of salicylic acid or a salicylate is added to a few drops of a cooled mixture of equal parts by volume of concentrated sulphuric acid and 40% formaldehyde, and a trace of ammonium vanadate is added, an immediate Prussian blue coloration, rapidly changing to green, is obtained. Salicylaldehyde gives a pale yellow coloration before the addition of ammonium vanadate, but otherwise reacts like salicylic acid. All other monophenols, polyphenols, or phenolic substances either give no coloration (except that given by the reagents alone, an orange coloration changing to green), or give various shades of red, brown, or green, usually changing to brown.—T. C.

Gallic acid; Bismuth salts of halogenated derivatives of ——. P. Lami. Boll. Chim. Farm., 1914, **54**, 2—5. J. Chem. Soc., 1915, **108**, i, 80.

BASIC bismuth dichlorogallate,

$$C_6Cl_2(OH)_3.CO_2.Bi(OH)_2,$$

prepared from dichlorogallic acid, m. pt. 155° C., is lemon yellow; the analogous basic bismuth dibromogallate from dibromogallic acid, m. pt. about 150° C., is olive green, and the di-iodogallate dark yellow. The two latter are of value as local astringents in dermatology. They are soluble in concentrated sulphuric acid with formation of a red and then a black coloration and evolution of vapours of the halogen.—G. F. M.

Glycerol; Condensation of acetone and benzaldehyde with ——. *Preparation of glycerol-α-methyl ether.* J. C. Irvine, J. L. A. Macdonald, and C. W. Soutar. Chem. Soc. Trans., 1915, **107**, 337—351.

THE products obtained by condensing glycerol with acetone or benzaldehyde were methylated, and the methyl derivatives hydrolysed with 0·5% hydrochloric acid. Glycerol-α-methyl ether was obtained, and hence isopropylidene-glycerol (acetone-glycerol) must have the constitution

$$HO.CH<\begin{matrix}CH_2.O\\CH_2.O\end{matrix}>C(CH_3)_2,$$

and benzylidene-glycerol an analogous formula.

Isopropylidene-glycerol was obtained by dissolving dry glycerol in a 1% solution of hydrogen chloride in acetone. It boils at 86·5° C. at 13 mm.; n_D = 1·4383; sp. gr. at 18°/4° C., 1·0727. Glycerol-α-methyl ether is a colourless neutral liquid, soluble in water and organic solvents, b. pt. 110° C. at 13 mm.; n_D = 1·4463; sp. gr. at 17°/4° C., 1·1197. Benzylidene-glycerol forms prismatic crystals of m. pt. 65° C.—G. F. M.

Allyl alcohol; Preparation of ——. F. D. Chattaway. Chem. Soc. Trans., 1915, **107**, 407—410. (See also this J., 1914, 218.)

ANHYDROUS oxalic acid (500 grms.) is added to an equal weight of glycerol in a 1·5 litre flask, which is then connected with a water pump and heated continuously on a water-bath for 4 or 5 hours until formic acid ceases to distil over. The residue is distilled very slowly, preferably using a short fractionating column, and all distillate below 210° C. is rejected. A mixture of allyl alcohol and allyl formate begins to distil at 220°—225° C., the reaction being practically complete at 230° C. No acrolein is formed unless the temperature rises above 240° C. The residue can be made up to 500 grms. by the addition of more glycerol, a further 500 grms. of oxalic acid added, and the process repeated four or five times. 50 grms. of sodium hydroxide in a litre of water is added to the mixture of allyl alcohol and allyl formate, and after hydrolysis of the ester is complete, the liquid is fractionated, allyl alcohol being obtained as a mixture of constant boiling point, 87°—88° C., containing 27—28% of water. Anhydrous allyl alcohol is obtained by treating this mixture repeatedly with anhydrous potassium carbonate and again fractionating. 500 grms. of glycerol and 500 grms. of oxalic acid give about 200 to 210 grms. of the constant boiling mixture or about 150 grms. of the pure alcohol in one operation. If all residues are worked up the yield is practically theoretical. Allyl formate can be obtained by direct fractionation of the crude allyl alcohol-allyl formate mixture. The addition of ammonium chloride to the reaction mixture offers no advantage.—T. C.

Selenioaldehydes. L. Vanino and A. Schinner. J. prakt. Chem., 1915, **91**, 116—127.

THE selenium analogues of certain thioaldehydes were prepared by the action of hydrogen selenide

upon aqueous or alcoholic solutions of aldehydes sometimes] in the presence of hydrogen chloride which appeared to have a determining effect upon what particular modification of selenioaldehyde was produced. The hydrogen selenide was generated by the action of water on aluminium selenide. Selenioformaldehyde, H.CSeO, a crystalline substance, m. pt. 215° C., was obtained by passing hydrogen selenide into an 18% formaldehyde solution to which had been added three times its volume of concentrated hydrochloric acid. It becomes bright green by exposure to light, and is only slightly soluble in most ordinary solvents. Selenioacetaldehyde, CH_3.CSeO, was obtained by the action of hydrogen selenide on acetaldehyde dissolved in three times its volume of alcoholic hydrogen chloride; it crystallised from alcohol in fine needles, m. pt. 139° C. Seleniobenzaldehyde, C_6H_5.CSeO, was obtained in three different modifications. Treatment of an alcoholic solution of benzaldehyde with hydrogen selenide in the absence of hydrogen chloride gave a blood red oil, and from the alcoholic liquid yellow crystals, m. pt. 83°—84° C., were obtained. The action of hydrogen selenide on benzaldehyde in solution in alcoholic hydrogen chloride resulted in the formation after three hours of a thick mass of crystals, which when recrystallised from benzene formed odourless golden yellow needles, containing a molecule of benzene of crystallisation, m. pt. 205° C. From the mother liquors a third or γ-seleniobenzaldehyde was isolated. It formed pale yellow needles, m. pt. 166° C. On heating the β-seleniobenzaldehyde (m. p. 205° C.) with copper powder, stilbene distilled over, a reaction similar to that given by α-thiobenzaldehyde.—G. F. M.

Gold salts and colloidal gold; Comparative pharmacological action of ——. H. Busquet. Comptes rend., 1915, **160**, 404—406.

WHEN a Ringer-Locke solution containing 0·01 grm. of colloidal gold per litre was passed through the isolated heart of a rabbit, the action of the heart was stimulated, whilst a similar dose of gold chloride arrested the coronary circulation and interfered with the cardiac action. Experiments *in vivo* showed that doses of colloidal gold diminished the frequency of the heart beats, increased their amplitude, and raised the arterial pressure of the blood; gold chloride accelerated the action of the heart, diminished the amplitude of the beats, and decreased the arterial pressure to such an extent as to cause death.—W. P. S.

Urotropine; Avoidance of the Trade-mark ——.

THE Trade-mark "Urotropine" (No. 215,652), registered by the Chem. Fabr. auf Actien, vorm. E. Schering, has been avoided by the Board of Trade. The application for avoidance or suspension was made on Sept. 18th last, but was adjourned for six months, on the ground that there were ample stocks of the substance in this country. At the adjourned hearing on March 3rd it was shown that the stocks had become exhausted.

Addition products of unsaturated organic compounds with nitric acid and picric acid. Reddelien. *See* III.

Use of orthoformic ester as an alkylating agent. Von Walther. *See* III.

Use of hydrochloric acid in the determination of certain forms of organic nitrogen. Drushel and Brandegee. *See* XXIII.

PATENTS.

Ethylene; Manufacture of ——. W. K. Freeman, Oscawana, N.Y., U.S.A. Eng. Pat. 24,019, Dec. 15, 1913.

IF the reaction between hydrogen and the carbon arc is sufficiently prolonged, the product is almost pure ethylene. Hydrogen is prepared electrolytically and passed under pressure, by means of a motor-driven pump, into two parallel tubes on either side of a series of arcs, enclosed in a practically gas-tight chamber. The hydrogen leaves the pipes by a series of platinum nozzles, one on either side of each arc, so that a lens-shaped mass of hydrogen is formed in the centre of each arc by the impinging streams; concave deflectors assist in retaining the hydrogen in the centre of the arc. A safety pressure valve is provided at one end of the chamber. The ethylene is led out by a tube which may be cooled if necessary. The motor for working the pressure pump, and the electrolytic chamber for generating the hydrogen are on parallel branches of the same electric circuit, the strength of which is regulated by a solenoid controlled by the current passing through the arcs; in this way the supply of hydrogen is varied, roughly, in accordance with the consumption of energy by the arcs. In an alternative apparatus, a number of arcs are produced by passing a suitable current through a mass of loosely packed lumps of carbon, contained in a chamber through which a slow current of hydrogen is passed.—B. V. S.

Diethylbromo-acetylurea; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Third Addition, dated April 29, 1914, to Fr. Pat. 417,803, July 2, 1910. Under Int. Conv., May 17, 1913. (See Eng. Pat. 2888 of 1910; this J., 1910, 1332.)

DIETHYLBROMO-ACETYLUREA,

$$(C_2H_5)_2CBr.CO.NH.CO.NH_2,$$

may be prepared by treating with ammonia the product of the action of bromine on diethylacetyl isocyanate, $(C_2H_5)_2CH.CO.NCO$, a colourless liquid boiling at 55° C. (23 mm.), obtained by heating diethylacetyl chloride with mercuric cyanate. —F. SP.

Aluminium acetate compounds; Manufacture of ——. G. Eichelbaum, Berlin, Assignor to Kalle und Co.. A.-G., Biebrich, Germany. U.S. Pat. 1,132,709, March 23, 1915. Date of appl., June 25, 1913.

SEE Ger. Pat. 272,516 of 1912; this J., 1914, 568.

Hexamethylenetetramine; Compounds of ——. F. Boedecker, Assignor to J. D. Riedel A.-G., Berlin. U.S. Pat. 1,133,916, March 30, 1915. Date of appl., Sept. 19, 1913.

SEE Ger. Pat. 266,123 of 1913; this J., 1913, 1129.

Orthovanadic acid esters and their solutions. L. Hess, Berlin. U.S. Pat. 1,133,961, March 30, 1915. Date of appl., Feb. 6, 1914.

SEE Ger. Pat. 273,220 of 1913; this J., 1914, 712.

Dihalogen-paraffins; Manufacture of ——. F. E. Matthews and H. J. W. Bliss. Fr. Pat. 472,642, May 25, 1914. Under Int. Conv., June 30, 1913.

SEE Eng. Pat. 15,048 of 1913; this J., 1914, 806.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic goods. Board of Trade Bulletin, No. 11

THE following figures show the value of certain descriptions of photographic goods exported from Germany and Austria-Hungary to all destinations, in a recent year :—

Exports from Germany (1912): Silver bromide, silver nitrate, and other silver salts and compounds, £60,900; collodion and celloidin, £7750;

chemical products, not specially mentioned, for photographic, cleaning, and other purposes, £369,350; photographic paper sensitised (ready for use), £233,100; dry plates for photographic purposes, £123,400; optical glass, crude, rough pressed optical glass, £58,250; spectacle glasses and other eye-glasses, stereoscope glasses, not ground nor mounted, £6150; other optical glasses, ground and mounted; stereoscopes; microscopes, unmounted lenses for optical purposes, £232,950; photographic lenses, ground and mounted; unmounted lenses for photographic purposes; photographic objects and apparatus of all kinds, £375,150; films, exposed or unexposed, of celluloid or similar materials, £376,600; total, £1,843,600. *Exports from Austria-Hungary* (1913): Paper prepared for photographic purposes, sensitised or not, £26,590; dry plates for photographic purposes, sensitised, £1500; optical glasses, other than spectacle glasses and watch glasses, polished, £14,300; total, £42,390.

The above particulars for Austria-Hungary are incomplete owing to the fact that many descriptions of photographic goods are not separately recorded in the Austrian official trade returns. The exports of photographic goods from the United Kingdom are not separately distinguished in our trade returns.

Germany's principal markets for photographic chemicals are the United States, Russia, United Kingdom, France, Switzerland, Italy, Denmark, Scandinavia, and Japan. There are a number of smaller markets also which would repay attention. For photographic paper and dry plates Germany's principal markets were Russia, United Kingdom (mainly sensitised paper), Switzerland, Western Europe, and South America, particularly Brazil and Argentina. The United States is relatively a small market for these goods. Films, exposed or unexposed, were sent chiefly to the United Kingdom, France, Italy and the United States, in which four countries the moving picture business has attained its greatest development. The principal markets for optical glass, photographic and other lenses, mounted and unmounted, and photographic apparatus of all kinds are the United Kingdom, Russia, France, Switzerland, Italy, United States, Japan, and Belgium, but there are quite a number of smaller markets to which the attention of British manufacturers of such goods might be turned.

Article.	In the United Kingdom Market.	In Colonial and Neutral Markets.
(A) *German Trade* (1912).	£	£
Bromide and nitrate of silver, other silver salts and compounds	1,850	39,300
Collodion and celloidin	500	5,950
Other chemical products for photographic and other purposes	43,300	280,200
Photographic paper (sensitised) ready for use	39,700	154,050
Dry plates for photographic purposes	2,550	78,400
Optical glass, crude; rough-pressed optical glass	5,550	51,650
Spectacle glasses and other eye-glasses, stereoscopic glasses, not ground nor mounted	300	5,300
Other optical glasses, ground and mounted; stereoscopes; microscopes: unmounted lenses for optical purposes	31,900	177,150
Photographic lenses, ground, etc., mounted or unmounted; photographic objects and apparatus of all kinds	66,150	249,700
Films, exposed or unexposed, of celluloid or similar materials	40,350	294,150
(B) *Austro-Hungarian Trade* (1913). Sensitised paper for photographic purposes	370	13,990
Total	232,520	1,349,840

The principal markets for Austrian-made sensitised paper are Russia (European), Sweden, Switzerland, Italy, and Roumania. The trade at best is a small one. The exports of other descriptions of photographic goods for which particulars are available go mainly to Germany.

The figures in the accompanying Table serve to indicate the volume of the trade in photographic goods which might conceivably be diverted to British manufacturers, thus making a grand total of £1,582,360.

Temperature coefficient of photochemical reactions. Berthelot. *See* XXIV.

Industrial uses of radium. Baker. *See* VII.

PATENTS.

Colour photography and colour printing. J. and E. Rheinberg, London. Eng. Pat. 22,764, Nov. 19, 1914. Addition to Eng. Pat. 22,938, Oct. 10, 1913 (this J., 1914, 1116).

THE transfusion of colours need not be complete, as stated in the chief patent, a satisfactory picture being obtained with only partial transfusion.
—B. V. S.

Celluloid varnishes; Process for applying adherent —— to viscose or similar cellulose films. Balland et Cie. Fr. Pat. 473,189, Sept. 11, 1913.

VISCOSE films can be coated with an adherent film of celluloid, and thus rendered impermeable to water, by interposing between the viscose and the celluloid a layer of glue or gelatin containing a considerable proportion of a resin soluble in solvents of celluloid. *Example*:—A solution of 200 grms. of glue in 300 c.c. of water is mixed with a solution of 100 grms. of shellac in 200 c.c. of alcohol and 10 c.c. of ammonia, and the product is diluted with 300 c.c. of water. The viscose film is coated with this solution, dried, and treated with dilute formaldehyde to render the glue insoluble and to destroy traces of ammonia. Celluloid solution is then applied, a firmly adherent film being obtained.—F. SP.

XXII.—EXPLOSIVES; MATCHES.

Explosion which occurred at the factory of the Schultze Co., Ltd., at Eyeworth, near Lyndhurst, Hants, on March 1, 1915; Report on the circumstances attending an ——. A. Desborough. No. CCXII.

TWO men were killed and one severely injured as a result of an explosion which occurred during the dismantling of three old boiler shells. The boilers had been used formerly for boiling nitrolignin, and the explosion was due to the ignition of an accumulation of nitrolignin below the wooden false bottom, possibly by a spark produced by an iron tool or a nail in the boot of the workman. It would not have taken place had the interiors of the boilers been thoroughly wetted before dismantling was commenced.—A. S.

PATENTS.

Explosive. J. F. O'Brien, Chicago, Ill. U.S. Pat. 1,132,873, March 23, 1915. Date of appl., Oct. 14, 1913.

THE explosive contains ammonium perchlorate (20 to 65 parts by weight), sodium nitrate (not more than 55), liquid dinitrotoluene (10 to 15), sawdust (14 to 23), and free carbon (1 to $3\frac{1}{2}$ parts).
—C. A. M.

Hexanitrodiphenyloxide (2.4.6.3′.4′.6′); *Preparation of ——.* Westfälisch-Anhaltische Sprengstoff-A.-G. Ger. Pat. 281,053, Nov. 23, 1913.

A di-, tri-, tetra-, or penta-nitro derivative o

diphenyl ether having at least one nitro-group in a meta position to the oxygen atom, is nitrated with mixed acid. The nitro derivatives mentioned may be prepared by condensing an alkali salt of *m*-nitrophenol with 2.4-dinitro- or 2.4.6-trinitrochlorobenzene, or by condensing a nitro derivative of chlorobenzene, containing at least one nitro group in a meta position to the chlorine atom, with an alkali salt of phenol or of *o*- or *p*-nitrophenol or 2.4-dinitrophenol. Hexanitrodiphenyloxide, m. pt. 269° C. (uncorr.), is insoluble in water, sparingly soluble in alcohol and ether, easily soluble in nitrobenzene. It is stable and relatively insensitive to percussion, but considerably superior to picric acid in explosive power (compare Fr. Pat. 460,571; this J., 1914, 44.)—A. S.

Generating heat by interaction between metals and metallic compounds. Fr. Pat. 473,095. *See* IIB.

XXIII.—ANALYTICAL PROCESSES.

List of reagents for analytical purposes, with notes indicating the standards of purity regarded as necessary for analytical work.

THE Councils of the Institute of Chemistry and the Society of Public Analysts have appointed a Committee to consider the recovery of that portion of the trade in fine chemicals for analytical purposes, which has been attracted away from this country. This Committee has prepared a list of reagents for analytical purposes, in which are indicated the standards of purity regarded as necessary for analytical work. The standards and tests are in the main those adopted by a Committee appointed by the Eighth International Congress of Applied Chemistry. The list has been brought to the notice of manufacturers, with the recommendation that the labels on the bottles containing materials complying with these tests should bear the letters, A.R.—signifying Analytical Reagent. Copies of the list may be obtained on application to the Registrar of the Institute of Chemistry, 30, Russell Square, London, W.C.

Sulphuric acid, calcium chloride, and aluminium trioxide; Comparison of the relative drying powers of —— when used in ordinary Scheibler desiccating jars. J. W. Marden and V. Elliott. J. Ind. Eng. Chem., 1915, 7, 320—321.

EXPERIMENTS are described showing the variable results obtained according to the conditions of working in the determination of moisture by drying over sulphuric acid. When weighed dishes of alumina and sulphuric acid were placed together in a desiccator, the alumina increased in weight faster than the sulphuric acid. In comparative tests with flour, crystallised copper sulphate, coffee, tea, etc., alumina gave somewhat better results than 95% sulphuric acid for small amounts of moisture and was equal to the acid for larger quantities; calcium chloride gave inferior results in all cases. The alumina was prepared by igniting the washed precipitated hydroxide in the glass tube of a combustion furnace, using a smoky flame.—A. S.

Potassium; Determination of —— by the perchlorate method. R. G. Thin and A. C. Cumming. Chem. Soc. Trans., 1915, 107, 361—366.

EXPERIMENTS were made to elucidate the causes and extent of possible errors in the perchlorate method for the estimation of potassium. Davis (this J., 1912, 1045) suggested washing the precipitate with 95% alcohol containing 0·2% of perchloric acid, but solubility determinations indicate that potassium perchlorate is distinctly soluble in alcohol (0·051 grm. in 100 grms. of 93·5% alcohol at 25·2° C.), and that the water added with the perchloric acid more or less counterbalances the slight decrease in solubility caused by the addition of the acid. Another source of error is the presence of traces of potassium perchlorate in the "pure" perchloric acid of commerce, which should therefore be redistilled *in vacuo* before use. Accurate results may be obtained if the following conditions are complied with. Ammonium salts must not be present in any quantity. Evaporation with the perchloric acid must be carried far enough to ensure complete conversion of chlorides into perchlorates. A freshly prepared saturated alcoholic solution of potassium perchlorate must be used as the washing liquid, instead of alcohol and perchloric acid. Since the presence of other salts, even up to 2 grms. of various chlorides, has no effect on the accuracy of the determination, the perchlorate method seems to be superior to the platinichloride method.—G. F. M.

Nitrogen; Use of hydrochloric acid in the determination of certain forms of organic ——. W. A. Drushel and M. M. Brandegee. Amer. J. Sci., 1915, 39, 398—404.

THE following method is proposed for the determination of nitrogen in aliphatic nitriles, cyanogen-substituted esters, amides, and imides:—0·1—0·3 grm. of the substance is heated with 3 c.c. of hydrochloric acid of sp. gr. about 1·2, for 2 hours at about 200° C. in a sealed tube. A considerable pressure of carbon dioxide is developed in some cases. The product is rinsed out into a basin, evaporated to dryness, further heated for 15 mins. on a water bath and afterwards for 5 mins. in an oven at about 110° C. By this means all free hydrochloric acid is eliminated without any appreciable loss of ammonium chloride, and the latter is then determined by titration with silver nitrate solution in presence of potassium chromate. The presence of acetic acid or its homologues does not affect the action of the chromate indicator, but if stronger acids, such as succinic acid, are present it is advisable to add a very small quantity of sodium acetate, preferably before the addition of the indicator. Tested on acetonitrile, propionitrile, propionamide, succinimide, and the ethyl esters of α-cyano-acetic, -propionic, and -butyric acids, and α-dipropylcyanoacetic acid, the method gave exact results, except with cyanoacetic acid, which was probably not pure. Accurate results were also obtained with glycine, but only after heating for 3—4 hours at about 200° C.
—J. H. L.

α-Amino-acid nitrogen; Colorimetric method for the determination of ——. V. J. Harding and R. M. MacLean. J. Biol. Chem., 1915, 20, 217—230.

THE method depends on a reaction discovered by Ruhemann (Chem. Soc., Trans., 1910, 97, 2025) who found that all acids containing a free amino group in the α position gave an intense blue coloration with triketohydrindene hydrate; β-, γ-, and δ-amino acids gave only slight colorations, whilst α-amino-acids substituted in the amino or carboxyl group did not react at all. One c.c. of the solution under examination, containing not more than 0·05 mgrm. of α-amino-acid nitrogen and having a neutral reaction towards phenolphthalein, is mixed with 1 c.c. of a 10% aqueous solution of pure pyridine and 1 c.c. of a freshly prepared 2% solution of triketohydrindene hydrate, the mixture is heated for 20 minutes on a boiling water-bath, then diluted and the coloration compared with a standard prepared under similar conditions from 1 c.c. of a solution containing 0·3178 grm. of alanine per litre (each c.c. of this solution will contain 0·05 mgrm. of nitrogen). The method may be applied to the determination

of the α-amino-acid nitrogen set free in the hydrolysis of proteins, but is untrustworthy in the case of cystine.—W. P. S.

[Determination of] soluble chlorides and total chlorine in some English cokes. Bridge. *See* IIA.

Tests for distinguishing parchment paper from pergamyn paper. Annoni and Rodano. *See* V.

Analysis of nitrites. Busvold. *See* VII.

Determination of chromium and vanadium in steel. Rich and Whittam. *See* X.

Analysis of brass. Koch. *See* X.

Electrolytic analysis of alloys rich in lead (white metal, type metal, solders, etc.). Compagno. *See* X.

Analysis of chrome yellows and greens. Given. *See* XIII.

Isolation of the insoluble constituent of rubber. Bernstein. *See* XIV.

High results in tannin analysis. Bennett. *See* XV.

Report on moellon analysis. Faust. *See* XV.

Cinchonine for the detection of sulphite-cellulose in leather. Appelius. *See* XV.

Analysis of sulphited tanning extracts, and determination of free sulphuric acid in leather. Dufour. *See* XV.

Determination of sulphuric acid in leather. Jablonski. *See* XV.

Determination of sucrose by double polarisation, employing a new method of clarification. Deerr. *See* XVII.

Determination of the mineral constituents in malt, wort, beer, and yeast. Schönfeld and Sokolowski. *See* XVIII.

Determination of sulphates in flour. Elsdon. *See* XIXA.

Capillary behaviour of milks. Lenk. *See* XIXA.

Use of colloidal iron [hydroxide] in the determination of lactose in milk. Hill. *See* XIXA.

Routine detection and determination of boric acid in butter. Hawley. *See* XIXA.

Determination of certain groups in phospholipins. Foster. *See* XX.

Determination of acidity [in physiological liquids]. Traube and Somogyi. *See* XX.

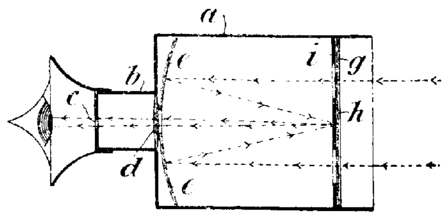
Separation and identification of hydroxymethylanthraquinones [in chrysarobin, buckthorn, rhubarb, senna, and aloes]. Bailey. *See* XX.

A new colour reaction of salicylic acid. Self. *See* XX.

PATENTS.

Photometers. South Metropolitan Gas Co., and J. S. G. Thomas, London. Eng. Pat. 776, Jan. 18, 1915.

A PHOTOMETER for determining, by direct viewing, the suitability of a given strength of illumination for a particular purpose, comprises an opaque tube, *a* (see fig.), closed at one end except for an eye-piece, *b*, containing a lens, *d*, and stop, *c*, and provided at that end with an annular concave reflector, *e*. At the other end of the tube is a transparent screen, *g*, and a circular, central, opaque disc, *h*, having a mark, *e.g.*, a black cross on a white ground, on its inner face. The amount of light entering the tube can be controlled



by an adjustable stop or diaphragm, *i*. The diaphragm, *i*, is set to give a certain visibility of the mark on *h*, with the required degree of luminosity; an excess of visibility then indicates too much light and *vice-versâ*.—B. V. S.

Viscosimeter. G. M. Saybolt, Jersey City, N.J. U.S. Pat. 1,132,621, March 23, 1915. Date of appl., Feb. 2, 1914.

THE liquid to be tested is contained in a tube provided with means for ensuring uniform filling, and surrounded by a constant-temperature bath which has an oscillating cover carrying agitating-paddles and a thermometer. The capillary nozzle at the lower end of the tube is surrounded by a larger tube which may be closed to form an air seal.—W. F. F.

Gas mixtures of known constituents; Method of quantitatively analysing —— and apparatus therefor. H. Gerdien, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 1,133,556, March 30, 1915. Date of appl., July 18, 1913.

SEE Fr. Pat. 458,916 of 1913; this J., 1913, 1171.

XXIV.—MISCELLANEOUS ABSTRACTS.

Photochemical reactions; Temperature coefficient of ——. D Berthelot. Comptes rend., 1915, **160**, 440—443.

THE decomposition of ketoses, such as dihydroxyacetone and lævulose, by light into carbon dioxide and lower alcohols may be used as a basis of actinometric measurements, *e.g.*, for comparing the efficacy of different sources of ultra-violet light for the sterilisation of water, etc.; the amount of gas formed in a given time is a function of the vibration frequency of the ultra-violet light. Such actions are but very slightly influenced by temperature changes. The temperature coefficient of the lævulose reaction between 40° and 70° C. was found to be 1·035. When oxalic acid and ferric chloride interact in sunlight, the ferric salt is reduced and carbon dioxide is liberated. The temperature coefficient of this reaction between 21° and 61° C., was 1·01, the same figure found by Lemoine for the temperature-interval, 3°—35° C. The vibration frequency is the intensity factor of light energy, just as temperature is that of heat energy.—E. H. T.

Nitric oxide; Behaviour of different substances towards ——. T. Panzer. Z. physiol. Chem., 1915, **93**, 378—395.

IT has been shown previously (see this J., 1913, 707) that after treatment with nitric oxide, diastase gives several reactions of nitroso-compounds. For purposes of comparison the author exposed weighed quantities of more than fifty compounds of various types (unsaturated compounds, non-volatile alcohols, phenols, aldehydes, carbohydrates, primary amines, proteins, amino-acids,

acid amides, and other nitrogenous substances) to a current of dry nitric oxide for 24 hours, and afterwards to a current of carbon dioxide. The increase in weight produced did not exceed 5% in most cases; the most conspicuous exceptions were turpentine oil, glycerol, phenol, *m*-cresol, β-naphthol, *p*-toluidine, β-naphthylamine, acetanilide, and antipyrin, which showed increases up to 22%, but in all cases very variable. Most of the products showed some, but none of them all, of the reactions given by diastase after similar treatment, and it is concluded that the active groups of diastase which are attacked by nitric oxide differ from any of those present in the compounds investigated.
-J. H. L.

Trade Report.

Prohibited exports.

ORDERS in Council, dated April 15th and 26th, amend the Proclamation of Feb. 3rd and the Orders in Council of March 2nd and 18th (see this J., 1915, 154, 381, 455) as follows:—

The headings "Oil, mineral lubricating (including mineral lubricating grease and lubricating oil composed of mineral and other oils)" and "Oil, whale, namely train, blubber, sperm or head matter, and seal oil, shark oil and Japan fish oil," in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, are deleted, and there are substituted the headings "Lubricants" and "Oil, whale (train, blubber, sperm), seal oil, shark oil, fish oil generally, and mixtures or compounds of any of the foregoing," respectively.

Alunite is added to the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates.

The following are added to the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain and Portugal:—Anthracite. Lacs of all kinds, including shellac, gum lac, seed lac, stick lac, and other forms of lac, but not including lac dye.

The exportation of toluol and mixtures containing toluol is prohibited to all destinations.

German chemical companies; Dividends of ——.

THE financial results of the great German chemical companies, which have just been published for the past year, are considered in that country as very satisfactory. After setting aside £450,000 for depreciation, as against £412,000 in 1913, the Badische Anilin und Soda Fabrik reports net profits, including £111,000 brought forward, of £789,000 as contrasted with £858,000 in 1913, when the carry forward was £99,000. It is proposed to allocate £150,000 to a war risks fund as compared with a similar amount for doubtful debts in the previous year, and to pay a dividend of 19% on ordinary share capital of £1,800,000, as against 28%, and 9½% on new capital of £700,000. The Farbenfabr. vorm. F. Bayer und Co. records net profits of £774,000, including the balance of £98,000 from 1913, as against £838,000 in 1913, and the directors recommend the payment of 19% on the ordinary share capital of £1,800,000, as compared with 28%, and 9½% on new shares of £900,000. In the case of the Farbwerke vorm. Meister, Lucius, und Brüning, the accounts show net profits and balance forward, after apportioning £284,000 to depreciation as contrasted with £272,000 in 1913, amounting to £630,000 as against £819,000. It is intended to distribute 20% on ordinary share capital of £1,800,000 as compared with 30%, and 10% on new capital of £700,000. The A.-G. f. Anilin-Fabrikation contemplates the payment of 16% on capital of £700,000 as against 23%, and 8% on the new issue of capital. The following dividend announcements have also been made for 1914, the figures in parentheses being those for the previous year:—Chemische Fabrik vorm. E. Schering, 11% (15); Chemische Fabrik vorm. Hell und Sthamer, of Billward, 10% (14); Chemische Dungerfabrik, Rendsburg, 10% (10); Chemische Fabrik E. Matthes und Weber, 10% (10); A.-G. Silesia Verein Chemischer Fabriken, 8% (12); Rütgerswerke A.-G., of Rulin, 10% (12); Akt.-Färberei Munchberg, vorm. Knab und Linhardt, 6% (8); and the Lübeck Schwefelsäure und Superphosphat A.-G., 7% (7) (see also this J., 1915, 455).

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

IIA. *Castellani*, L. e. *Romanelli*, U.: L'acetilene e le sue pratiche applicazioni. 3a. ediz. Milano, Hoepli. 16°, p. XX, 335. 1915. Lire 4.

Brewer, R. W. A.: Carburation in theory and practice; including a criticism of carburettor development; a manual of reference for automobile engineers and owners. N.Y., Appleton. 253 p. il. diagrs. tab. 8vo. 1915. $1.50 n.

Kohlen-Jahrbuch 1915. Ratgeber f. Gewinng., Handel u. Konsum v. Kohle, Koks, Briketts u. anderen Heizmaterialien. Mit umfass. Kalendarium u. Notizbuch. 15 Jahrg. 1915. 2 Tle. in 1 Bde. (XII, 296; IV, 54 S., Schreibkalender u. 8 S. m. Fig. u. 1 Karte.) 18°. Leipzig, Degener. 1915. Cloth M. 3.

VII. *Strickland*, Sir W. W.: Notes and observations on forms of sand. Illustrated. Cr. 8vo. swd. Smithson and Blanchard, London. 1915. 1s. 6d.

VIII. *Stull*, R. T., and others: Deformation temperatures of some porcelain glazes. Urbana, Ill., Univ. of Ill. 14 p. diagrs. tabs. 8vo. (Ceramics bull.) pap. 1915. 10 c.

Williams, A. E.: Notes on the development of the ruby color in glass. Urbana, Ill. Univ. of Ill. 23 p. tabs. 8vo. (Ceramics bull.) pap. 1915. 15 c.

X. *Heat-treatment* of steel. 8vo. Spon. London. 1915. Net 10s. 6d.

White, C. H.: Methods in metallurgical analysis. 106 illustrations. N.Y., Van Nostrand. c. 9+356 p. (3½ p. bibl.) 1915. D. $2.50 n.

Swingle, C. F.: Oxy-acetylene welding and cutting; including the operation and care of acetylene generating plants; and the oxygen process for removal of carbon. Chic., Drake. c. 190 p. il. figs. 1915. S. $1.

XIV. *Lock*, R. H.: Rubber and rubber planting. N.Y., Putnam. 1914. 11+245 p. il. pls. 1915. $1.50 n.

Rubber Recueil: A series of papers about rubber: its botany, culture, preparation and commerce. 4to. Unwin. London. 1915. Net 21s.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.